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Coal Mining Methods in England

The Hulton Colliery Secures Coal without Explosives, and Is the Only Mine in England Ventilated Electrically by Underground Fans

BY FLOYD W. PARSONS

Great Britain, like many other European countries, is in many ways, a minus nation. The British are minus wheat, corn, cotton, iron and copper, while on the plus side of the balance sheet we may place coal, brains and free-trade. Coal is the most valuable natural resource in the British Isles.

According to the estimates of the Royal Commission appointed in 1871 to inquire into the probable duration of the coal supply, the available resources of the country in seams of 1 ft. thick and upward, situated within 4000 ft. of the surface were about 90,000,000,000 tons. In the final report of the Royal Commission on coal supplies in 1905, the amount still available, of the same thickness and within the same distance of the surface, was given as more than 100,000,000,000 tons. Great Britain still has many unproved areas, so that notwithstanding the immense annual production, the end of the coal industry must still be considered as in the distant future.

The chief coalfields of Great Britain are: South Wales, area, 920 square miles; Somersetshire and Gloucestershire, area, 150 square miles; Forest of Dean, area, 34 square miles; North Staffordshire, area, 75 square miles; South Staffordshire, area, 93 square miles; Warwickshire, area, 30 square miles; Lancashire, area, 217 square miles; North Wales, area, 82 square miles; Yorkshire, Derbyshire and Nottinghamshire, area, 760 square miles; Northumberland and Durham, area, 460 square miles; coalfields of Scotland, 1547 square miles.

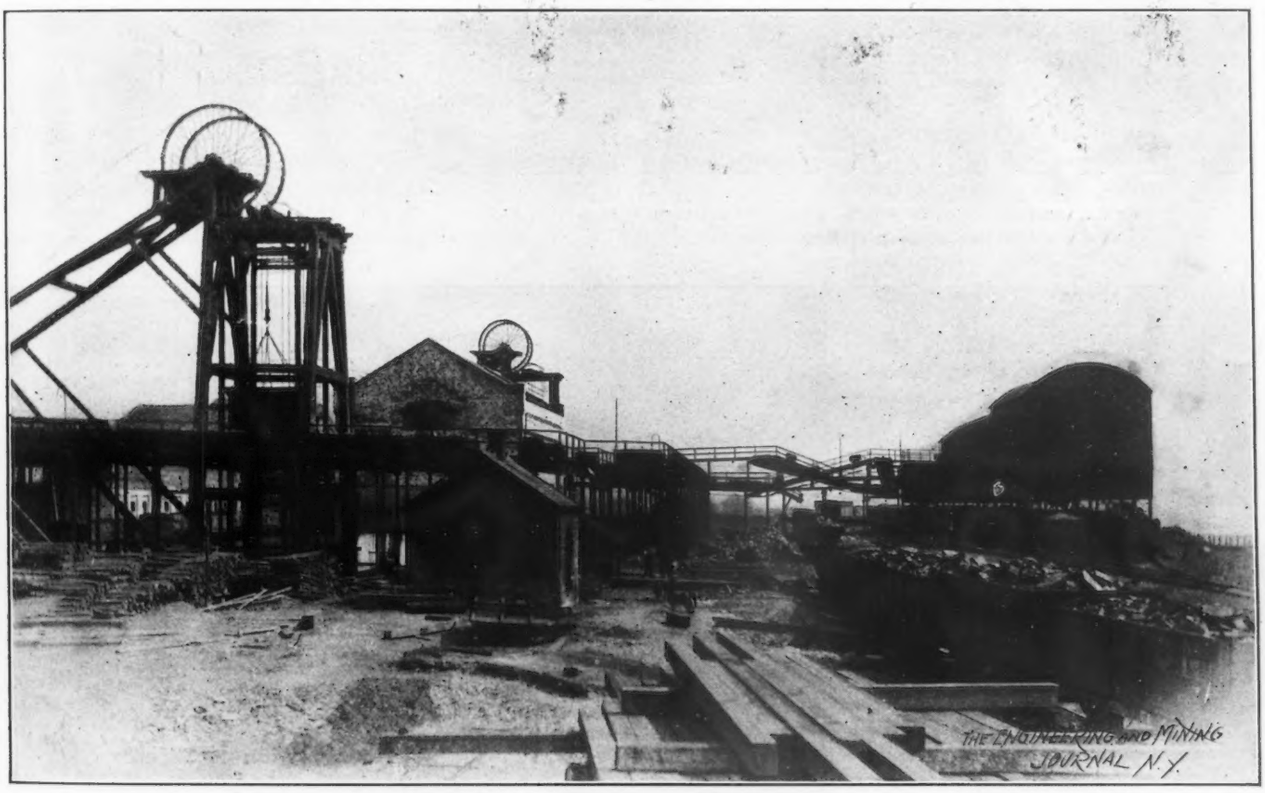


FIG. 1. HULTON COLLIERY COMPANY, LANCASHIRE, ENGLAND. VIEW SHOWING BANKING ARRANGEMENT, POWER AND SCREENING HOUSES

The Lancashire Coalfield

From a standpoint of methods used and equipment supplied, the mines in the Lancashire field are of great interest. In this district, there are 18 seams having a thickness of more than 2 ft.; according to the latest estimate, the quantity of available coal is about 4,500,000,000 tons. The dip of the coal measures is generally toward the south. Large faults traverse the field in a northwesterly direction. The deepest development work in the Lancashire field is carried on in the lower coal measures at a depth of about 2100 feet.

The surface equipment at the best mines in Lancashire is superior to the modern mines in the United States. The shafts are usually circular, and the method of mining is generally longwall. The most widely developed seams vary from 3 ft. to 7 ft. in thickness. Under no circumstances is any coal shot from the solid,

and the law with respect to the use of permitted explosives, when explosives are used, is carefully obeyed. As a result of careful timbering, good ventilation and systematic shot firing, the percentage of accidents has been reduced to a minimum.

The power house is placed midway between the two shafts. The building has two stories, the upper of which is the engine room, and the lower is divided into an electrical fitting shop, repair shop, condenser room, and transformer chamber.

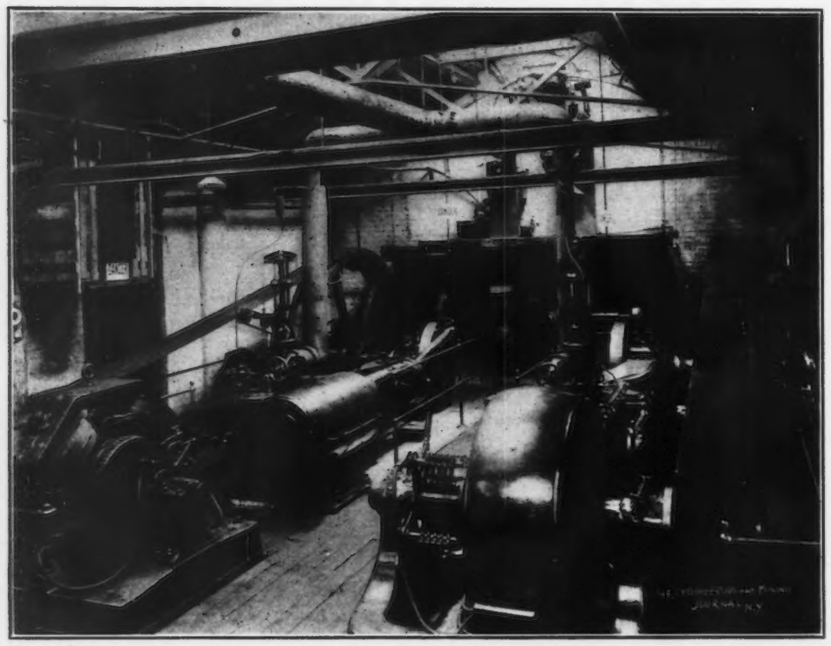


FIG. 2. ELECTRICAL GENERATORS AT THE CHEQUERBENT PITS OF THE HULTON COLLIERY COMPANY

The Hulton Colliery

The Hulton mine, situated at Chequerbent, about 30 miles northeast of Manchester, is one of the representative collieries in the district. Coal is here hoisted from what are known as the Nos. 3 and 4 Atherton pits. The No. 3 pit winding engine has cylinders 32 in. in diameter, with a cylindrical drum 15 ft. in diameter. The depth of winding is 900 ft. The engines are controlled by foot and steam brakes, and the ropes are fitted with Ormrod's patent safety detaching hooks.

The No. 4 pit hoisting engine has cylinders 36 in. in diameter, with a cylindrical drum 18 ft. in diameter. This engine hoists from two different mines of 450 and 1320 ft. depth respectively. The safety arrangements are the same as those on the No. 3 pit engine.

Boilers

The boiler plant consists of ten boilers, half of which work at 100 lb. per sq.in., and the others at 150 lb. per sq.in. steam pressure. The low-pressure boilers supply steam for the winding engine, while the high-pressure ones supply the electrical generators. The high-pressure boilers are fitted with forced draft equipment. All of the boilers are fed through economizers by means of electrically driven three-throw pumps, one being of the variable stroke type. A steam pump is retained as a stand-by.

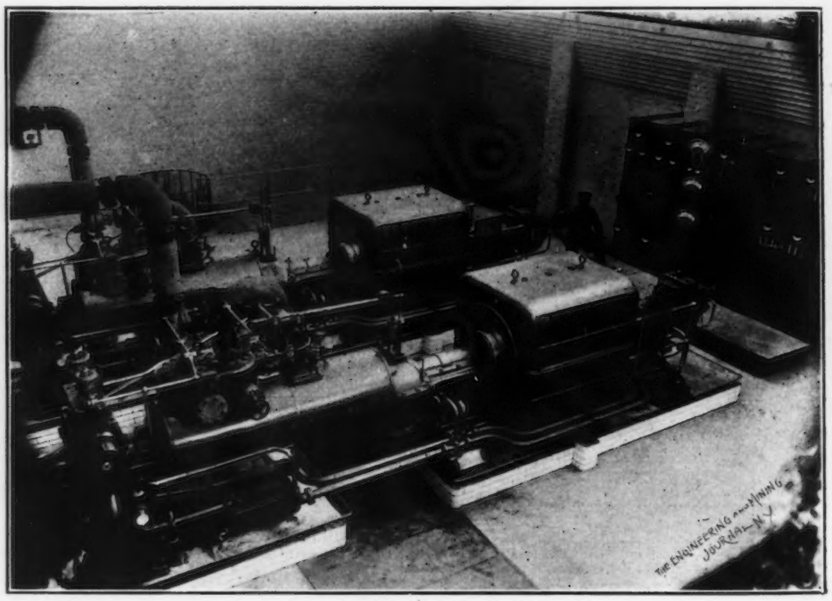


FIG. 3. INTERIOR OF POWER HOUSE, ATHERTON PITS, SHOWING PARSON'S TURBO GENERATORS

The Electric Plant

The engine room contains three Parsons' 3-phase turbo-alternators, with high- and low-voltage switchboard. One of the alternators is of 350 kw. and the other two of 300 kw. normal capacity; all three alternators are capable of standing 25 per cent. overload for two hours. The voltage is 465, speed, 3000, steam pressure, 150 lb., and the turbines work condensing. The circulating water to the condensers, which are of the ejector type, is supplied by two motor-driven centrifugal pumps.

Power is supplied from these generators for the whole of the work at the Nos. 3 and 4 shafts, with the exception of hoisting, and also for a considerable portion of the work at the Chequerbent and Atherton No. 1 pits. This power is conveyed to the Atherton No. 1 shaft by means of an overhead transmission line about 1¼ miles long, the voltage being transformed up at the power house to 3300 volts. At the other mine (the Chequerbent pit) the power is applied without stepping down, to a 150-h.p. motor-driven ventilating fan, and to two 125-h.p. motors driving direct-current generators. These two motors have taken the place of two horizontal steam engines, which were originally installed.

The larger switchboard in the power house controls the supply of power to the Nos. 3 and 4 shafts, and the smaller one the high-voltage transmission line. The transformers, situated on the lower floor, are three in number and of 120-kw. capacity each. The work to which electric driving is applied comprises ventilating, screening, pumping, hauling, coal cutting, boiler feeding, forced draft, sawing, air compressing, briquet making and other purposes. There is also an extensive installation for lighting.

The management at the Hulton collieries have tried both three-phase and direct-current systems, and after detailed investigation, it is asserted that the three-phase system is far superior. It is, however, acknowledged that the men must be

better trained for the three-phase system.

The new turbine, which has only recently been installed, is run entirely by exhaust steam from the winding engine. In case the winding engine is stopped, an automatic arrangement has been installed whereby it is possible to shift to live steam. If the turbine is not in use, the winding engine exhausts into the atmosphere.

The Screening Arrangement

The cages are of the two-deck type, holding three cars on each deck. The cars on leaving the cage gravitate to a creeper chain, which conveys them to the weighing machine at a higher level. The tipplers are mechanically driven, and the screening is done by means of shakers. The picking belts are of wire webbing, and the coal is lowered into the cars by means of mechanically controlled lowering arms. The small sizes of coal are stored in bunkers, from which the coal is let out into the railroad cars by means of trap doors as required. The empty cars from the tipplers gravitate round a curve to a creeper chain which elevates them to such a hight that they then run by gravity to the back of the shaft.

The railway sidings lead under the screens, and then on to the car-weighing machine. A diversion from the main line leads on to the briquet siding, on the side of which is built the briquet house. The sidings are so laid that the railway cars gravitate gently to the various points of call and away again when liberated. The services of a locomotive are not required from the beginning of this operation until the cars have been filled, weighed and placed in the sidings.

FIG. 4. GENERAL VIEW OF ATHERTON PITS

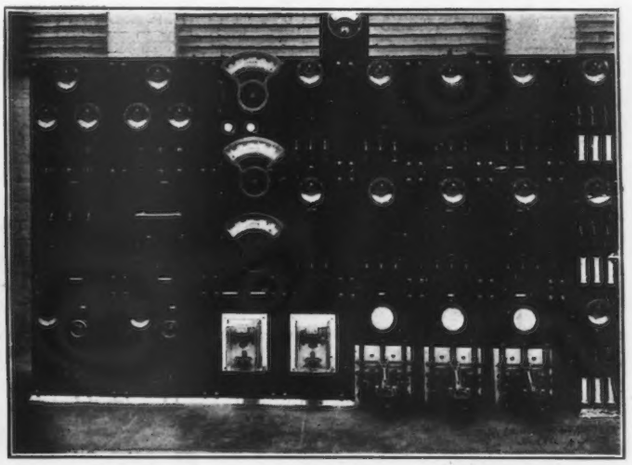


FIG. 5. SWITCHBOARD IN POWER HOUSE

FIG. 6. HYDRAULIC MINING CARTRIDGE BEING INSERTED IN HOLE. THE COAL HAS BEEN UNDERCUT AND SPRAGGED

FIG. 7. THE OPERATOR IS PUMPING AND THE COAL IS JUST PARTING FROM THE ROOF

Included in the surface equipment is a briquet plant, water-softening and purifying plant and a "Korting" water-cooling system. This latter arrangement is used to reduce the temperature of the water in the lodge from which the circulating water for the turbine condensers is taken. This "Korting" system of water cooling is successfully used at many European mines.

The Underground Arrangement

The general system of underground development at the Hulton collieries is most deserving of imitation. All the underground roadways have been carefully laid out with a view to facilitating the quick handling of coal. The haulageways are well ballasted and laid with heavy steel, so that trips of cars can be drawn at moderate speed. The uppermost seam, known as the Trencherbone mine, is equipped with an electrical hauling engine, having a rope of the endless type. This mine is ventilated by an underground fan (30-in. "Sirocco") rope driven by an electrical motor of 30 h.p., giving about 20,000 cu.ft. of air per minute at a 1-in. water gage. There are two large pumps, both being of the three-throw type and driven by an electric motor; the one nearer the shaft pumps about 10,000 gal. of water per hour.

The Yard mine, operating in the middle seam at a depth of 900 ft., is also equipped with an electrical hauling engine of the endless-rope type. This mine is ventilated by an underground 45-in. "Sirocco" fan, which is rope driven by a 45-h.p. electric motor; this ventilator gives about 50,000 cu.ft. of air per minute at a 1⅞-in. water gage.

The Arley mine, operating in the lowest seam at a depth of about 1320 ft., has an

electric hauling engine of the endless-rope type, and is ventilated by an underground 45-in. "Sirocco" fan, which is rope driven by a 45-h.p. motor, giving about 50,000 cu.ft. of air per minute at a 1½-in. water gage.

The "Hurd" coal cutter is used in the upper seam, while the "Diamond" disk three-phase coal cutter is used in the lower seam. In the three-quarters mine, which is reached by a tunnel from the Arley mine, there is fitted up an electrically driven "Ingersoll-Sergeant" air compressor, which works one of the "Ingersoll" heading machines of the percussive type.

A Unique System of Ventilation

The Hulton colliery in its methods of ventilation, as in many other respects, is unique in the history of coal mining. No other colliery in Great Britain ventilates the entire mine electrically by underground fans, with an auxiliary standby fan on the surface. Investigation showed me that at all points underground, in the different mines, the air currents were more than sufficient. The management after careful investigation and actual tests has pronounced this underground system of ventilation as most successful.

Only one important argument is advanced by the opponents of the underground system, and this unfavorable comment is summed up in the statement that the underground fans are likely to be destroyed in case of an explosion. The Hulton management claims that the damage to its fans would not be great in case of an explosion, due to the fact that the ventilator is located in a blind-way, as shown in the drawing Fig. 8. It is argued that in case of an explosion, the force would pass directly along the entry, in a straight line, passing through the door shown on the main entry in Fig. 8. During the ordinary working of the mine, this door is held shut by a weight suspended over a pulley. The door is designed to swing outby, so that in case of an explosion, it would open easily and permit the passage of any unusual force.

It is further stated in support of this system of underground ventilation, that even though all of the underground ventilators were disarranged, there is a 98-in. double-inlet "Sirocco" fan on the surface which can be called into immediate service. This large standby ventilator is driven by a 300-h.p. three-phase motor.

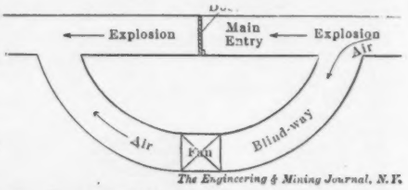


FIG. 8. GENERAL ARRANGEMENT OF BLIND-WAY TO PROTECT FAN

The current supplied to this motor is 465 volts.

The Hydraulic Mining Cartridge Is Used

The general system of mining is long-wall. The working face is carefully gobbed and timbered, so that fatalities from roof falls seldom occur. The main entries, as well as the face, are sprinkled regularly. The management has found that the roof is not affected by this plan of watering down the dust.

One of the most interesting features in connection with the Hulton collieries is the hydraulic mining cartridge, which is the sole power used for bringing down the coal. The general method employed is to have regularly appointed drillers who drill a 3-in. hole at 6- or 8-ft. intervals along the face and near the roof of the coal seam. Following these drillers comes the man with the cartridge, who inserts this machine and after applying the pressure for several minutes, the coal is heard to rumble and then break away from the roof. The general arrangement and operation of the cartridge are shown in Figs. 6 and 7.

The cartridge consists of a steel cylinder about 20 in. long, and having six or eight small duplex rams fitted radially along the cylinder. By an arrangement of passages a communication is made between each of these rams, whereby simultaneous action is obtained. The cartridge is operated by a small hydraulic pump, to which it is connected by a pipe. The pump is fitted with a small water tank. The water required for the whole operation is about 1½ pints, and this water returns to the tank, so that it can be used again. There are different-sized cartridges, the smaller ones giving a total pressure on the coal of about 60 tons; the larger cartridge is capable of a pressure on the coal of 120 tons.

At the Hulton colliery, each cartridge produces approximately 90 tons per day. About 74 per cent. of this production is large coal. Before the cartridge was introduced explosives were used and only 61 per cent. of the output was lump coal. The large coal at the Hulton colliery sells for $3.50 per ton at the mine, while slack only brings about $1.60 per ton. The profit obtained from the use of the cartridges is, therefore, considerable.

Freedom from Accidents

The voltage carried underground for all power purposes is 465. The cable used to carry this current is three-core, paper, lead covered, and is armored with galvanized wire. All miners carry Marsaut lamps, which they secure from the lamp room in the morning before going down the pit. All of these lamps are carefully numbered, and in this way the men are checked in and out of the mine each day. The fire-bosses use the Wolf lamp.

It is evident from the foregoing description that the management of the Hulton collieries has taken every precaution to insure against accidents. Since the abandonment of explosives, there has been no explosion of any kind at these mines. The only accident that has occurred in recent years was a mine fire. In overcoming this trouble the officials used chemical extinguishers and water under pressure.

FIG. 9. LAMP ROOM SHOWING HOW EACH LAMP IS NUMBERED

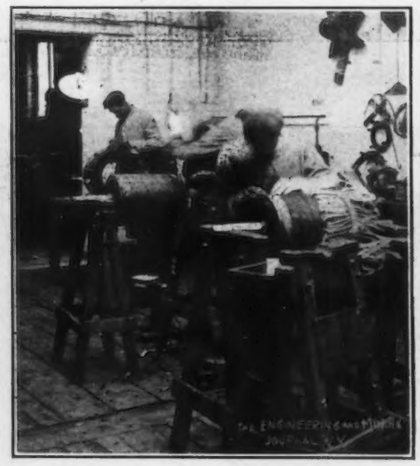


FIG. 10. ELECTRICAL FITTING AND REPAIR SHOP

FIG. 11. COLLIERY LASSIES IN REGULATION COSTUME

Working Costs on the Witwatersrand

SPECIAL CORRESPONDENCE

The marked reduction of working costs on the mines of the Witwatersrand during the last two years and the low level that they have now reached, mark a distinct revolution in the history of mining. As a whole they reflect an eminently satisfactory state of affairs.

However, when one comes to consider the performances of the individual mines one finds that a proportion of this reduction is fictitious. The difficulty of finding out which are obtaining the best results is surprising when one remembers that they are all working on the same orebody and one too that possesses a uniformity of characteristics that is hardly approached by any other ore deposit; certainly not by any other gold occurrence. In spite of the unique similarity the various factors which influence the working costs of the different mines are found to vary within wide limits. For want of a better mode of comparison the cost per ton milled has come into use locally for purposes of comparison. As a result, in the strenuous—one might almost say panic-stricken—efforts of the various managers to avoid being left behind, a serious abuse has crept into Rand mining methods. This has been remarked on from time to time locally and recently has afforded some fruitful discussion in the *So. Afr. Min. Journ.* This abuse lies in crushing a proportion of easily obtained unpayable rock and hence a larger tonnage, thus reducing the working costs per ton milled at the expense of true economy.

The fallacy of this mode of comparison, originated and still condoned by the Chamber of Mines in its published monthly table of statistics, may be illustrated by imagining a 12-in. reef to be extracted in one mine from 60-in. stopes and in another from 36-in. stopes, the whole being milled; the resulting working costs per ton milled in the second case would be about 25 per cent. more than those of the first, though the second would be working with the greater economy. Few managers have the courage to continue what are commonly supposed to be high working costs, though they can only lower them at the expense of true economy.

IDEAL PRACTICE FOR NARROW VEINS

There can be no doubt that the ideal practice in exploiting narrow mineral seams like the reefs of the Witwatersrand is to combine the closest stoping with the maximum sorting. To permit of this, however, there must be two assured factors, namely, an adequate labor supply and a commensurate mill capacity. The labor must be sufficient to supply the mill with the ideal product—that is, reef with a minimum of waste—while, conversely, the mill must be coördinated to the amount of the ideal product made available by the labor. Unfortunately this ideal practice is not always attainable on the Witwatersrand for the reason that the labor supply periodically falls below the normal, while in most cases the mill capacity is larger than the normal labor supply warrants. Nevertheless the principle remains true.

In some cases, no doubt, as the late Wager Bradford maintained, it is more profitable, during periods of labor scarcity, to discard sorting altogether, and to employ the men who would be required for that purpose on stoping. On the other hand a large percentage of waste has to be supplied to many of the mills, even with the normal labor complement, because of the excessive size of the former and the consequent inability of the latter to supply a sufficient quantity of the ideal product. The ideal practice is thus often prevented by the existing labor and mill conditions, and the loss entailed thereby is an after effect of error of judgment in the initial equipment of the mines. Yet this error remains unheeded. It is more than doubtful whether the huge mills proposed for many of the new properties now completing their preliminary development are justifiable. Still, although the ideal practice can seldom be attained, every effort should be made to approach it as closely as individual circumstances permit.

RELATION OF COSTS TO PROFITS

The most interesting contribution to this problem is the paper by H. Musson Thomas, manager of the City and Suburban mine, and until lately manager of the Jumpers Deep, on "The Relation of Costs to Profits in Mines of the Rand."

Mr. Thomas starts from the hypothesis that the "Minimum waste milled increases the costs and profits per ton milled (waste and reef), but the profits are increased in a greater ratio, and, although the pay limit is higher, some of the unpayable ore reserves become payable, or, maximum reef milled decreases the costs and increases the profits per ton of reef milled, and some of the unpayable ore reserves become payable." A series of interesting calculations are given upon these bases.

He assumes a mine of 300 claims which contains two reefs with a 30-deg. dip. The average reef thickness is 24 in., which will produce a value of 6 dwt. over a 60-in. stope width. The reduction plant consists of 200 stamps and four tube mills with a crushing capacity of 40,000 tons per month. With this postulate he gives the variation in costs and profits in detail for seven different working policies, and shows what would be the result if the external waste were gradually reduced from 36 to 12 in., and at the same time, the maximum amount of waste were sorted out on the surface, thus insuring the minimum waste or the maximum reef being milled. These figures are, of course, not intended to be taken as anything more than approximate, because, although he fixes the more important factors, there still remain many others which are uncertain.

COMPARISONS OF MINES TAKEN AS A BASIS FOR DISCUSSION

The basis mine *A* sorts 20 per cent. of waste (from stopes of an average width of 60 in.) at the surface. The *C* mine sorts 20 per cent. also, but reduces the stope width to 54 in. by leaving 6 in. of waste in the hanging and foot, which, when compared to the basis mine, is equivalent to sorting 10 per cent. on the surface; this, together with the 20 per cent. sorted, makes an equivalent of 30 per cent. sorted. Mine *G* only sorts 10 per cent. on the surface, but through reducing its external waste to 12 instead of 36 in., is credited with 50 per cent. less waste milled.

He also assumes that all rock is broken by machines. With the costs per ton milled for the *A* mine at 16s. 1d., those for the *G* mine are shown to increase to 19s. 6d. The profits are, however, increased from 11s. 10d. to 19s. 10d. per ton milled, or an increase of 8s. per ton. The 60-in. mine would have a life of 23.1 years, whereas the 36-in. mine would be worked out in 15.6 years, or a decrease of 33 per cent. Although the 36-in. mine has a decreased life of 7.5 years, yet in the shorter time it would yield £847,000 more profit.

In discussing this paper of Mr. Thomas, it was pointed out that the truth of the principle became more obvious on the west Witwatersrand and the western extension where most of the mines depend largely on the there extremely thin South reef. An excellent demonstration of the truth of the principle is afforded by the Central Roodeport Deep mine. This is working the South reef, which averages about 1 in. in thickness and 190 dwt. gold. It is equipped with the small crushing capacity (50 stamps, and has no tube mills) necessary, under the circumstances, to permit of high sorting and narrow stope width. During 1908, 27 per cent. of the rock hoisted was sorted, and the stope width averaged 34 in. The resulting milling width was 24 in., averaging only 8 dwt. During 1908, 104,030 tons were milled, with a working profit of £37,635. This in spite of nontreatment of slimes and heavy timbering costs—the stopes requiring very close timbering. It is obvious that the application of this principle alone makes this comparatively poor undertaking payable. This is probably the most economically worked mine on the Witwatersrand, yet its working costs were 24s. 8d. per ton milled.

The Development of Heavy Gravitation Stamps

A Series of Tests Which Resulted in the Recommendation of 1500-lb. Stamps on the Rand; Heavy Stamps Compared with Lighter Ones

BY W. A. CALDECOTT*

The history of ore crushing by means of gravitation stamps shows a progressive increase in their weight and in corresponding efficiency. This holds good in the development from the square wooden non-rotating stamps in use in Germany in the Middle Ages[1] to iron-shod wooden stamps in Cornwall, and then to rotary iron stamps in California and mild-steel stamps in South Africa. The latter have greatly improved during the last few years, and probably represent the highest existing stage of development. About 1835, the first stamp mill in the United States was started at Tellurium, Virginia.[2] The stamps weighed 50 lb. and were made of square wooden stems with iron shoes and dies, the cams operating in slots in the stems.

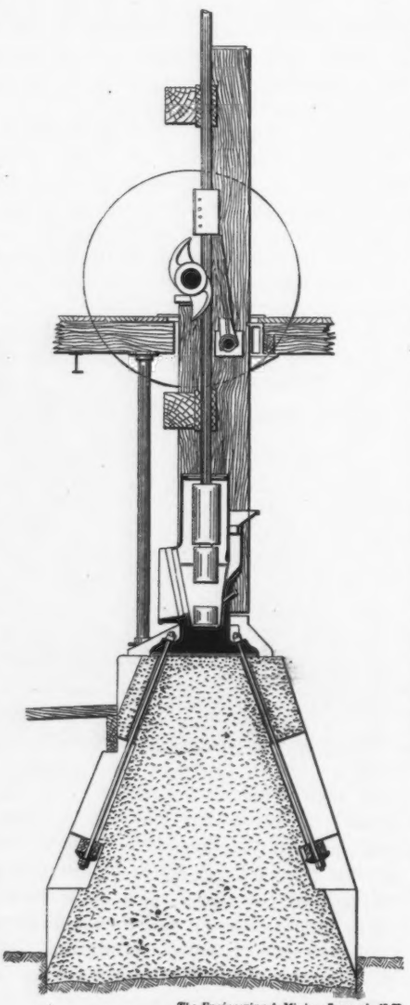
Ten years later the Vaucluse mine installed 380-lb. stamps, of which the head weighed 125 lb. When the first batteries were erected on the Rand over 20 years ago, California practice probably represented the highest state of the art, and was introduced upon these fields by J. S. Curtis, J. H. Hammond and other well-known Californian mining engineers.

Stamp Duty of 3 Tons on Rand, 1889

To illustrate the type of battery in operation on the Rand in 1889, in which year my experience of stamp milling began, the following details may be given of the Du Prez Gold Mining Company's mill, premising that this was before the introduction of the cyanide process, and that concentrators, other than blanket-strakes and buddles, were not in common use.

The mill was erected in that year and was of Sandycroft make, designed in accordance with the best Californian practice to date. It consisted of 20 stamps weighing 900 lb. each when new, and was run at the rate of 90 seven-inch drops per minute. The stamp duty was about 3 tons per 24 hours, using a screen of 900 meshes per square inch.

By 1899 some progress had been made and 1250-lb. stamps were in use at the Robinson Gold Mining Company and elsewhere, though in Australia and the United States 900 lb. per stamp remained the almost universal maximum limit, and this remains true of the celebrated Homestake mills at the present time. At the Mount Morgan Gold Mining Company (Westralia), in December, 1902, 30 stamps weighing 1500 lb. each were erected. These were eclipsed, however, by the neighboring Millionaire Gold Mining Company's battery of five stamps weighing 1750 lb. each.[3] The advance made on these small companies was not generally realized, and in 1907 few stamps dropping on the Witwatersrand weighed more than 1250 lb., with the exception of certain batteries of Consolidated Goldfield companies, as will be noted later.



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1670-POUND STAMP

In 1904, I was authorized by R. M. Catlin, acting consulting engineer of the Consolidated Goldfields, to carry out a series of milling tests at the Knights Deep battery, which was equipped with stamps weighing 1350 lb. when new. The object of the trials was to discover some means whereby stamp-milling efficiency could be increased.

Scope of Tests

The initial experiments were made to test the effect of fine breaking before stamp milling, and also whether the increased discharge area afforded by a double discharge mortar box increased the stamp duty. A pair of rolls was installed to effect the preliminary fine breaking, and also a double-discharge mortar box. A special staff of men was employed to carry out the trials, and most complete and detailed records were kept.

The tests extended over more than a year, and a considerable amount of money was expended in testing many variations of conditions, such as varied angles of screen frames, hights of discharge and of drop and different methods of water introduction into the upper portion of the mortar box.

An accompanying table illustrates some of the many experimental runs.

The results of these typical trials with a double discharge mortar-box and with fine breaking before stamp-milling are almost identical within the limits of experimental error.

The above conclusions were confirmed by the fact that the average stamp duty on ordinary mill-feed for six pairs of parallel trials was 5.82 tons with a double discharge mortar, and 5.82 tons with a single discharge mortar.

The average stamp duty for four pairs of parallel trials on the product from rolls set ½ in. apart was 5.64 tons with double discharge mortar, and 5.78 with a single discharge mortar. There was no increased duty to compensate for the extra cost of preliminary fine breaking,[4] and the only difference with the double discharge mortar-box was a considerable increase in the amount of water used.

This last conclusion is in accordance with the fact that the ordinary single battery screen has about 40 per cent. of its area available for discharge, or, say 1½ sq. ft. of discharge area for the small stream of pulp yielded by five stamps.[5] It will be observed that in trial, many flat pieces of ore which had passed the rolls ½ in. apart remained on a coarser screen used in the grading analysis.

*Box 1167, Johannesburg.

Note—Abstract of a paper in *Bull.* 59, Inst. of Min. and Met., Aug. 12, 1909.

[1]Remarks by Bennett H. Brough, *Proc.*, Inst., Civ. Eng., Vol. 108 (1892), during discussion upon paper by A. H. Curtis on "Gold Quartz Reduction."

[2]Crane's "Gold and Silver," p. 473 *et seq.*

[3]*Aust. Min. Stand.*, Dec. 8, 1909; also *Journ.*, Chem., Met. and Min. Soc. of South Africa, Vol. 7, Sept., 1905, p. 92.

[4]Also *Journ.*, Chem., Met. and Min. Soc. of South Africa, Vol. 6, Jan., 1906, p. 215.

[5]Lock's "Gold Milling," p. 79.

Increased Crushing Requires Heavier Blow

Finally it became obvious that to crush more rock it was necessary to strike a heavier blow. This was sought by affixing helical springs round the stem above the tappet so as to be compressed by the upper guide during the stamp's rise, and so that when released the stamp would fall more rapidly, rendering a higher drop practicable, and would likewise strike harder. While this object was in some measure fulfilled, the noise in the mill was much increased and the life of the springs did not promise to be long. Hence, finally, the conclusion was reached that a simple increase of stamp weight was the best course.

A series of runs was then made whereby direct comparisons could be obtained of the actual tonnage milled by alteration in the weight of the stamps. An accompanying table exemplifies the increased tonnage obtained by increased weight of stamp on ordinary mill feed, both under ordinary milling conditions, and with a high discharge and back water feed to obtain a very fine product.

Another run with 1337-lb. stamps having a hight of discharge of 2 in. and a 64-mesh screen gave a duty of 10.23 tons per 24 working hours of which 52.8 per cent. remained on a 60-screen. The water-feed adopted in this test consisted of inlets at an angle of 45 deg. at the back of the mortar-box, as suggested by the late H. T. Pitt.[6]

1550-lb. Stamp Recommended

Encouraged by the results of these and many other tests, including a duty of approximately 6½ tons through 1500-mesh screening with stamps weighted up to 1622 lb., I felt fully justified in recommending that the next 360 stamps erected by Consolidated Goldfields Companies, at the Simmer East, Robinson Deep and Luipaards Vlei, should have a weight of 1550 lb. each when new.[7]

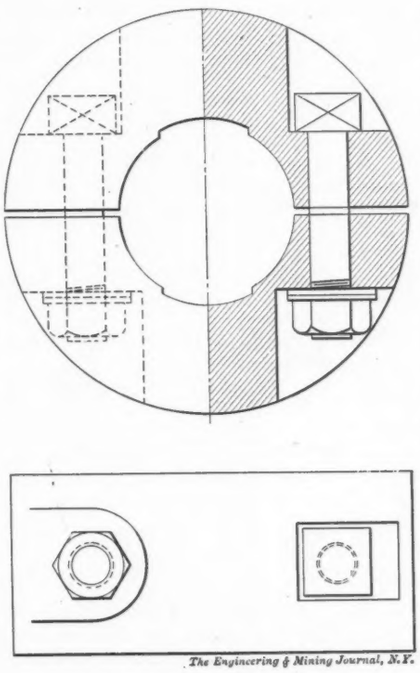
Such a departure excited much adverse comment among experienced millmen generally, on the ground that no foundations could stand the shocks, but the reasoning that if foundations could be built to endure the blow of the colossal steam stamps, it would be possible for them to be built to withstand gravitation stamps, proved correct. All the above mills are satisfactorily at work today after periods of service ranging up to three years, and the foundations promise to last as long as did their lighter predecessors.

In accordance with the present changed state of professional opinion, all Rand batteries lately erected or designed have stamps of a weight not long ago deemed extravagant, and aided by the installation of tube-mills, stamp duties of 8 tons are as common as of 4 tons but a few years previous.[8]

While in the United States and in Mexico the relatively light stamp is still generally upheld, there is at least one notable exception in the recently built mill of the Boston Consolidated Copper Company which is equipped with 312 single Nissen stamps of 1500 lb. weight each and with a 9-ton duty.[9]

An accompanying diagram illustrates a modern heavy gravitation stamp with its mortar-box, as used in the Simmer Deep Jupiter joint mill. The total weight is 1670 lb. distributed as follows: Shoe, 285 lb.; head, 410; stem, 723; tappet, 252.

Results obtained on a large scale under regular working conditions by the use of heavy stamps are given by an accompanying table, and it further shows in the case of the Simmer East that while stamps alone can be used with a high discharge to produce a fine product, yet the later use of tube-mills as well yielded at the same total cost a product with fewer coarse (+0.01 in.) particles and hence a still more perfect exposure of the gold.



CAST-IRON WEIGHT FOR STAMPS

Cast-Iron Anvil Blocks Not Needed

Somewhat later than the series of battery tests already described the matter of battery foundations was also investigated. It was recognized that timber foundations were unsuitable for heavy stamps, their liability to decay rendering them less durable than the then recently introduced cast-iron anvil blocks. However, it had never been practically proved since the introduction of these anvil blocks that they were superior to concrete foundations in themselves, and that this point might be elucidated, I had a series of 23 comparative trials carried out in 1906 on two five-stamp batteries side by side in the Simmer East mill, the one with a concrete block only, and the other with a cast-iron anvil block as well, shown in an accompanying cut.

The results of the parallel trials were on the average practically indentical. These extended from the use of 100-mesh screening to 1400-mesh, and the cast-iron anvil block battery showed an average stamp duty of 6.84 tons as against 6.78 tons for the concrete block, the average screen-grading analysis of the latter showing, however, only 25 per cent. of +60 (0.01-in.) grade as against 26.76 per cent. for the cast-iron anvil block.

The question of the life of the concrete block without timber or a cast-iron anvil block has received attention also, and one mortar-box, erected on H. C. Behr's recommendation at the Simmer East mill, upon a concrete block with only a thin layer of insertion between, has been in use now for three years with no visible sign of cracking or deterioration. This has been so encouraging that at the Simmer Deep and Jupiter mills all the batteries have been erected with the mortar-box resting on the concrete blocks.

Impact or Abrasion

Crushing is usually performed either by impact or abrasion, and though hard ores are best dealt with by the former method, the latter is applicable to softer material. The relative efficiency of the two methods for hard material is well illustrated by the case of the diamond, which is hardly capable of abrasion at all except by its own dust, whereas, if placed on an anvil, it will be shattered into a thousand fragments by one blow of a hammer.

As has been pointed out by C. de Kalb, the crushing of the larger pieces of ore in stamp milling is done as the result of reaction from the resilient die, the waves of compression transmitted through the ore from the shoe being reflected from the die, until the strains set up from the oncoming and reflected waves exceed the elastic limit of the ore, and rupture results.[10] The stamp is essentially an impact machine, and hence readily pulverizes hard tough ore.

Such ore, if handled in any of the legion of rubbing or shearing appliances, would only be reduced at the expense of serious wear by abrasion of costly steel

[6] *Trans.*, I., M. M., 1904, Vol. 14, p. 164; also *Journ.*, Chem., Met. and Min. Soc. of South Africa, 1908, Vol. 8, p. 374.

[7] Annual report of Cons. Goldfields of South Africa for 1905, p. 32; also report for 1906, p. 27, and report for 1907, p. 28.

[8] *So. Afr. Min. Journ.*, p. 802, Sept. 19, 1908; p. 1016, Nov. 14, 1908; p. 1100, Dec. 5, 1908; p. 1348, Feb. 6, 1909; 1860-lb. stamps with a 12-ton estimated stamp duty are to be erected on the West Rand Consolidated property (*So. Afr. Min. Rev.*, p. 232, Nov., 1908).

[9] Eng. and Min. Journ., Sept. 14, 1907, p. 433.

[10] *Mines and Minerals*, p. 135, Oct., 1906; O. H. Howarth in *Mines and Minerals*, p. 441, May, 1906; and *Journ.* Chem., Met. and Min. Soc. of South Africa, Vol. 6, June, 1906, p. 385.

parts which may have to be discarded when but a fraction of their weight has been worn away. With soft material the case is different, and machines of the latter class may be employed with advantage and without undue abrasion of wearing faces.

It is much to be regretted that no satisfactory machine for testing the capacity of material to resist abrasion, or conversely of testing the abrasive capacity of materials requiring reduction, yet exists, as this property is of prime importance in all crushing operations.

Gravity Stamp an Impact Machine

When gravity stamps are used for very fine crushing, they pass beyond the economic range, and operate by abrasion rather than by impact, with consequent reduction of efficiency, as may be seen from the following considerations. Impact is essentially dependent upon the pressure exerted by the blow, and depends upon the weight of the stamp and the hight of the drop. Assume that a 1750-lb. stamp having a 9.5-in. diam. shoe and with a set hight of drop of 8 in. strikes a layer of ore 2 in. thick on the die, and comes to rest 0.5 in. from the die. Then having fallen 7.5 in. and having done work for 1.5 in., it has exerted on the ore a mean total pressure of 8750 lb.[11] The shoe having an area of 71 sq. in., the average unit pressure exerted over the whole of its area is only 123 lb. per sq.in., or less than that exerted by a man of average weight supported upon an area of 1 sq.in.

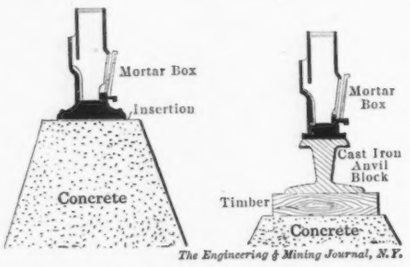
The crushing effect of such a pressure on hard quartz grains is trivial, and a certain amount of reciprocal abrasion of grains of sand rearranging themselves under pressure is probably the main effect produced. The case, however, is quite different in the first impact of the stamp on the ore in the box. Assume that only a 2-in. cube resting on the die is first struck; having an area of 4 sq.in., the average unit pressure here is 2190 lb. per sq.in., or 18 times as much as under former conditions.

The finer the crushing is carried in the battery the longer sand particles remain before sufficiently reduced to escape, and the higher the ratio of fine to coarse material in the mortar-box. Hence, under these conditions the liability is for the falling stamp to have its force of impact distributed over so large an area as to produce little effect but abrasion on a bed of shifting compressible sand. These considerations serve also to explain why fine breaking before milling with heavy stamps does little good. A large number of pieces of ore of approximately equal size afford a large area to receive the blow of relatively small pressure upon each. And further, the abrasive action, above referred to, explains why stamp milling with a fine screen and a high discharge, or both combined, is inefficient through the waste of energy in converting fine sand into slime by abrasion of the particles rearranging themselves under the stamp.[12]

As regards the desirable size to which ore should be broken before entering the mortar-box, the disadvantage of too fine crushing yielding a uniform bed has already been pointed out. The maximum limit varies with the class of ore, being less for hard ores, but in general it should be such that not more than one blow of a stamp is required to pulverize the largest piece of rock. Hence, the heavier the stamp, the coarser the preliminary breaking admissible, and *vice versa*. With unweathered banket ore probably a maximum diameter of 1¾ in. is permissible. Larger pieces are more economically reduced by the rock breaker and the lowering of stamp duty, owing to less actual hight of drop with such a feed, is thus avoided.

Compensating Weights

Taking the average running weight of a stamp as with a half-worn shoe and with a stem of less than its original length,



MORTAR BOX, WITH AND WITHOUT ANVIL BLOCK

owing to breakage, it will be found that this weight is about 10 per cent. less than the weight of the stamp when new, and that its duty is correspondingly reduced. The obvious remedy is the use, as the shoe wears down, of compensating weights in some form or other, which have been frequently suggested and occasionally used.[13]

Since, however, greater attention has been directed to the weight of stamps through the trials on the Knights Deep referred to, the use of compensating weights has become common on the Rand, and their importance in maintaining a high efficiency and stamp duty is so considerable as to be well worth the small additional trouble and expense involved by their use. Probably the earliest form of this device was placing an old head at the top of the stem, or an extra tappet above the one in use.

These devices were, however, crude, and the writer has tried various other methods, including a false head intermediate between the true head and the shoe, on the ground that additional weight is better added near the bottom than near the top of the stem. Probably the most convenient compensating weights, however, are split cast-iron disks about 4 in. high, and weighing about 50 or 60 lb. each, which are clamped on the stem by means of two bolts either above or below the tappet. Such a compensating weight is illustrated in an accompanying sketch, and as many may be gradually added as are needed and can be accommodated.

Area of Shoe and Die

With increased weight of stamp, the question of increased shoe and die area arises, but the considerations already advanced, showing the small amount of pressure per square inch of total shoe area, indicate that very large shoe and die areas are not needed for hard ores, while for soft ore a lower, quicker drop can be used. Some increase, however, is usual owing to the fact that the larger diameter of stems and tappets required with heavier stamps necessitates increasing the distance between stamp centers.

An increase is desirable when the total force of impact of the falling stamp requires a thick layer of ore on the die to avoid excessive shock. Such heavy feeding lessens the duty, because the thicker ore bed reduces the actual hight of drop, and the blow is likewise cushioned so that the stamp crushes by abrasion rather than by impact. As already shown, the cushioning caused by fine particles in the mortar-box increases with the hight of discharge and the fineness of the screen.

The greater the force of impact per unit of area the coarser the screen required for maximum efficiency, as otherwise a thick layer of fine ore particles would be needed to avoid pounding. Since even a heavy stamp crushes but a couple of ounces of ore at each blow, and this weight would form but a very thin layer over the surface of the die, it is obvious that the least thickness of ore layer necessary to take the impact of the stamp without pounding is sufficient to supply ample material for pulverization.

The prevention of irregular wear of dies is as yet an unsolved problem. At first sight it would appear that a slight cavity in the die surface due to soft metal would, when formed, be protected against further excavation by the surrounding portions of the die standing above it, but in practice no such protection seems to be afforded. The cavity grows steadily deeper with use, and even turning the dies regularly is not a cure.

In my opinion the trouble is due to the larger pieces of ore, or pieces of steel such as drill ends, gravitating in the swirl of pulp in the mortar-box to the lowest point, that is, into any slight depression originally due to softness of the metal, and thus

[11] Cf. Hiscox, "Compressed Air," p. 437.

[12] E. A. Hersam's paper on "Economy of Power in Crushing Ore," published in *Min. and Sci. Press*, Nov. 16, 1907, p. 624; also C. de Kalb in *Mines and Minerals*, p. 136, Oct., 1906.

[13] Lock's "Gold Milling," p. 109; also *Journ., Chem., Met. and Min. Soc. of South Africa*, Vol. 2, April, 1898, p. 299.

the impact of the falling stamp is transmitted to gouge out the bottom of the cavity. Such irregular wear is especially liable to start at the back of the center dies where the ore feed first lodges and is thus struck while at its largest size.[14]

Tube Mills for Regrinding

Consequent upon the introduction of tube-mills, coarse battery screening has generally replaced the finer mesh, and thanks to the work of this Institution, and of the Chemical, Metallurgical and Mining Society of South Africa, more accurate descriptions are now applied to screening,[15] with the result that the millman can with some certainty obtain a duplication of a previous order.

In accordance with the demands of the modern millman armed with a micrometer gage, manufacturers' catalogs, in place of giving vague trade terms, now detail diameters of aperture, wire and so forth, with a most laudable desire for extreme accuracy.

Since this development, however, the general introduction of secondary grinding by means of tube-mills has lessened the importance of the battery screen as a criterion of the degree of reduction of an ore, and, in fact, the grading analysis of the final pulp leaving the crushing plant as an overflow of the hydraulic classifiers is now the guide to the metallurgist.

This change makes the degree to which a particle is reduced dependent upon both its diameter and its specific gravity, instead of upon the former only, with the result that the pyritic material undergoes that finer comminution and more perfect exposure of gold contents which its greater value renders desirable.[16]

Breakages

Breakages of cam shafts as well as stems and other battery parts are still commonly described as being due to "crystallization" set up by vibrations incidental to the operation of crushing. At the present day, however, such an explanation cannot be accepted, it having been proved that repeated shocks in time develop, in such essentially crystalline aggregates as iron or steel, minute microscopic crevices which gradually extend until a fracture results.[17]

Among the few who have initiated improvements in stamp-mill design of recent years is that experienced millman, M. P. Boss, whose design of a stamp with long head, thus giving strength at what would otherwise be a weak point in the stem, is worthy of serious investigation.[18]

TABLE SHOWING DUTY OF HEAVY STAMPS.

	Luipaards Vlei.	Simmer and Jack East.	
	(August, 1908.)	(May, 1907.)	(January, 1909.)
Tonnage milled during month	18,807 tons	35,500 tons	29,600 tons
Number of stamps	60	250	130
New weight of stamps	1629 lb. (with 18½-ft. stem)	200 at 1550 lb. 50 at 1350 lb.	1550 lb.
Running weight of stamps	1520 lb	200 at 1450 lb. 50 at 1250 lb.	80 at 1450 lb. 50 at 1550 lb. (with compensating weights)
Average drops per minute and set hight of drop	98.6 at 8½ in.	96 at 8 in.	96 at 8 in.
Duty per stamp per 24 working hours	9.667 tons	5.006 tons	8.333 tons
Hight of discharge	4 in.	9 in. (average)	3½ in.
Screen used and aperture	200 (0.056 in.) and 250 (0.046 in.)	1600 (0.016 in.) and 1200 (0.017 in.)	200 (0.057 in.) and 400 (0.035 in.)
Ratio of water to ore by weight	8 to 1	8 to 1	6.46 to 1
Percentage of + 60 (0.01-in.) grade in screen pulp	43.7%	10.92%	1.61 (final pulp)
Cost of crushing per ton of ore—			
(*a*) Stamps	1*s.* 3.879*d.*	1*s.* 10.424*d.*	1*s.* 3.672*d.*
(*b*) Tube mills	6.215*d.*	.....	7.070*d.*
(*c*) Total	1*s.* 10.094*d.*	1*s.* 10.424*d.*	1*s.* 10.742*d*

TYPICAL TESTS WITH STAMP MILL.

	(*a*) Single Discharge Mortar. Ordinary Mill Feed.	(*b*) Single Discharge Mortar. Ore from Rolls Set 0.5 in. Apart.	(*c*) Double Discharge Mortar. Ordinary Mill Feed.
Running weight of stamp	1343 lb.	1342 lb.	1356 lb.
Set hight of drop	7½ in.	7½ in.	7½ in.
Drops per minute	98	98	98
Duty per stamp per 24 working hours	5.85 tons	5.68 tons	5.81 tons
Hight of discharge	2¾ in	Level	3¾ in.
Screen used and aperture	700 (.024 in.)	700 (.024 in.)	700 (.024 in.)
Ratio of water to ore by weight	7.67 to 1	8.35 to 1	10.70 to 1
Percentage of + 60 (0.01 in.) grade in screen pulp	29.00%	27.50%	26.00%
Ore feed + 1¾ in.	54.8	1.1	49.9
− 1¾ + ¾ in	14.3	19.3	16.3
− ¾ in	30.9	79.6	33.8

It is somewhat remarkable that while the number of crushing machines invented to supersede stamps is endless, and much space in metallurgical publications is devoted to the description of crushing plants, yet the actual operation of the gravitation stamp and the discussion of its most appropriate design has been but little dealt with either by the skilled engineer or by the mathematician.

In order to employ heavy gravitation stamps to full advantage, it is absolutely necessary that a uniform speed be maintained by proper governing of the engine. Only under these conditions can the maximum speed and hight of drop be safely used without fear of camming; and the damage done in a few moments by sudden increased speed above the normal may prove a costly matter both in loss of time and material. Further, with heavy stamps the use of 5-stamp cam shafts is desirable, in that as compared with 10- or 15-stamp cam shafts, both the power to be transmitted and the number of shocks due to lifting stamps are reduced by one-half or two-thirds for each shaft.

Stamp Mills Still the Standard Machine

Many attempts have been made to supersede the use of gravitation stamps as the standard machine for the crushing of gold-bearing ore, but without success. That, in spite of certain obvious disadvantages, they still hold their own, is probably due to the fact that pneumatic and steam stamps as hitherto designed have proved wasteful of power and liable to derangement under the vibrations and shocks inevitable during crushing, while the gravitation stamp has little to go wrong, and power can be cheaply developed by a complex and economical steam engine removed from unfavorable conditions and tended by a skilled operator without other duties. A serious effort is, however, now being made to utilize a new type of Holman pneumatic stamp at the New Kleinfontein mill, and there is no doubt that the energy and experience of those concerned in this test will, if it is possible, overcome such difficulties as have been encountered in the past with similar crushing appliances.

From the foregoing discussion it will be evident that the day of the stamp as a unit of crushing capacity has passed way. The unit of the present basis is the tonnage crushed per month or per day, and this is dependent on many factors—the relative proportion of stamps to tube mills, the actual running weight of the stamps, the ratio of water fed, the hight of discharge, the hight and number of drops per minute, the screening used, and the maintenance of "concert pitch" in the mill engine.

The future limit of stamp weight is difficult to foretell, but it will probably be

[14] *Journ.*, Chem., Met. and Min. Soc. of South Africa, Vol. 7, 1907, p. 216 and 293; also paper by M. P. Boss on "Crushing Ore," *Min. and Sci. Press*, March 14, 1901, p. 356.

[15] *Journ.* Chem., Met. and Min. Soc. of So. Africa, June, 1906, Vol. 6, p. 393; also Oct., 1907, Vol. 8, p. 130.

[16] *Trans.* Inst. Min. and Met., Vol. 14, 1904, p. 55.

[17] Rosenhain on "The Crystallization of Iron and Steel," in the *Times Eng. Supplement*, p. 1, Nov. 6, 1907.

[18] *Mines and Minerals*, p. 209, Dec., 1908.

determined more by the mechanical considerations involved, as in the cam system of lifting, than by any decreased relative efficiency as a device for pulverizing ore.

HEAVY STAMP COMPARED WITH LIGHTER

The advantages of heavy stamps, as compared with lighter ones, may be briefly stated as follows:

(1) Reduction of the initial capital expenditure in erecting, say, 200 stamps at 1750 lb. with accessories, in place of 280 stamps at 1250 lb. each; (2) reduction in size of mill building, almost proportionate to the less number of stamps; (3) 30 per cent. less shafting, belts and other moving parts to maintain; (4) 30 per cent. less labor required for dressing plates, lubricating moving parts, changing screens, and other work incidental to milling operations.

In concluding this somewhat lengthy, yet incomplete discussion of some of the factors affecting present-day stamp milling, it is my pleasant duty to acknowledge my indebtedness to the Consolidated Gold Fields of South Africa, whose foresight provided means whereby a departure was rendered possible which, beside benefiting the gold-mining industry in general, has enabled them to claim "the heaviest stamps and the highest average stamp duties of any gold-mining corporation in the world;"[19] and to Messrs. R. M. Catlin, H. H. Webb, and H. C. Behr and their staffs for greatly appreciated encouragement and suggestions during the progress of the experimental work detailed.

TABLE SHOWING INCREASED TONNAGE FROM HEAVIER STAMPS.

Apertures per Sq. In. in Screen Used.	Running Weight of Stamps, Lb.	Set Hight of Drop, In.	Hight of Discharge, In.	Tons Water per Ton Ore.	Tons Ore Crushed per Stamp per 24 Working Hours.	+ 60 (.01 in.) Grade in Screen Pulp. Per Cent.
981 (0.021 in.)	1196	8	3	5.8	5.88	22.63
981 (0.021 in.)	1279	8	3	5.8	6.58	22.23
981 (0.021 in.)	1531	8	3	5.7	6.74	20.86
1512 (0.016 in.)	1216	8	11	5.40	4.26	5.16
1512 (0.016 in.)	1288	8	11	5.30	4.29	4.91
1512 (0.016 in.)	1293	8	11	5.43	4.55	9.49
1512 (0.016 in.)	1337	8	11	6.27	4.96	6.66
1512 (0.016 in.)	1562	8	11	5.05	5.17	....
1512 (0.016 in.)	1605	8	11	6.30	6.02	11.66

According to *Rassegna dell' Industria Solfifera,* the new bill for the regulation of the sulphur industry, presented to the Italian parliament, is intended to take the place of the laws of July 15, 1906, June 6, 1907, and July 5, 1908, relative to the "Consorzio." The object of the principal modifications is: (1) to simplify administration and reduce the number of directors; (2) to authorize the "Consorzio" to cede to one party or company the sale of its total production for the whole term of the former's existence (12 years from Aug. 1, 1906), and (3) to restrict the output, as far as possible, to the consumption.

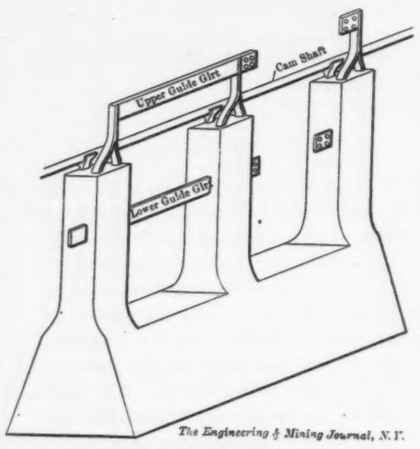
[19] "Annual Report of the Consolidated Gold Fields of South Africa, Ltd.," 1908, p. 30.

Battery Posts of Reinforced Concrete

BY ALGERNON DEL MAR*

Some one has remarked that it was about time stamp-mill constructors broke away from the conventional designs and adopted something new. The accompanying sketches will supply a new idea. With the successful use of cement for battery foundations, which surely must have suggested the further application of this material, millwrights have stopped short as if afraid to go on to the logical end. We see battery posts bolted to short wooden sills which are in turn bolted to the concrete. This is crude and soon leads to loose battery posts. Why not make the battery post itself of reinforced concrete? It requires only a pillar 10 ft. high from top of mortar-block to cam-shaft boxing. "Yes, but the vibration," they say. Why not cushion the vibration? It looks practicable to me.

One objection to the all-steel battery frame is the extreme rigidity. With the cam-shaft vibrations cushioned this objection would be negatived. There can be little doubt that reinforced concrete is superior to steel in this connection. A feature of the reinforcement might be an 8-in. pipe with attachments running the whole hight of the column, the top being the pipe used for the cushion spring.

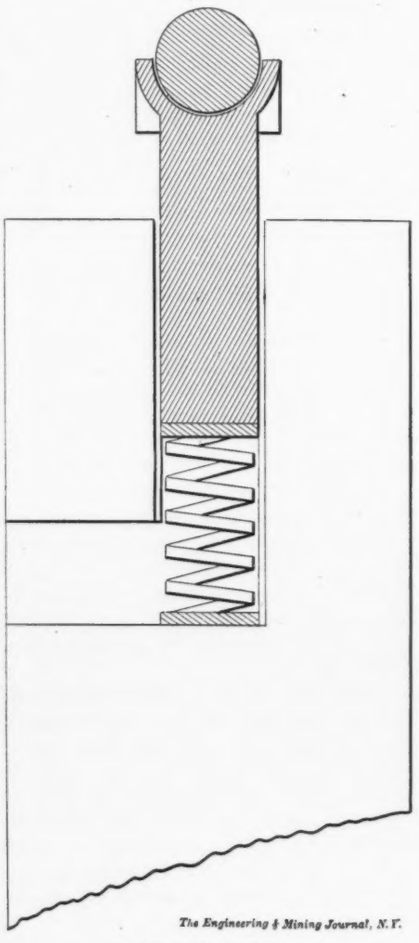


CONCRETE BATTERY POSTS

*Mining engineer, South Pasadena, Cal.

The guides may be bolted to a cast-iron girt bolted to brackets embedded in the concrete, or to a girt running through the pillars and changeable. With little or no vibration in the battery pillars there would be no fear of girts breaking. The casting for the upper guides is 4 ft. above top of pillar and should be embedded at least 2 ft. in the concrete.

To cushion the vibrations of the cam shaft, the boxing or bearing is a long cast-iron cylinder resting on a heavy railroad-carriage spring which in turn is within an 8-in. pipe imbedded in the concrete. An opening is left in the concrete pillar for the purpose of inserting iron shims under the spring to bring it into alinement. The springs must be heavy and with just enough give to take up the vibrations without producing oscillations. Strips of rubber belting might answer the purpose.



CAM-SHAFT BOXING

According to the *New Zealand Mines Record,* April 16, 1909, the Campbell's Creek Dredging Company, Victoria, grew trees and lucerne on its ground after the dredging operations had been completed. The Closer Settlement board recommended that the land be taken up for growing lucerne.

Sinking a Reinforced Concrete Mine Shaft

A Circular Shaft, 21 Feet in Diameter, through 190 Feet of Water Bearing Strata; Approximate Cost of the Shaft Was $500 per Foot

BY ALBERT H. FAY

At the Morton Mine, Hibbing, Minnesota, the Foundation Company, of New York, is sinking a shaft for the Todd-Stanbaugh Company, of Cleveland, O., that is an extraordinary piece of work requiring perseverance, skill, energy and capital. The ground through which the shaft is being sunk is a water-bearing gravel and sand 190 ft. thick. There are occasionally strata of tough clay, the thickest of which is about 10 ft. near the 160-ft. level. There was also one layer of hard cemented conglomerate about 2 ft. thick which caused some trouble as it had to be blasted. Below the 190-ft. level is 40 ft. of taconite which lies directly upon the iron ore. The shaft is only a few hundred yards from Carson lake and, strange to say, the water level of the shaft is 7 ft. below the level of the lake. It would seem that this is due to the fact that the bottom of the lake is covered with an impervious layer of clay.

Shaft Construction

The shaft is 21 ft. inside diameter, circular in form, with wall 4 ft. thick, making the outside dimension 29 ft. The concrete portion will be at least 190 ft. deep or until an impervious solid stratum is reached. The concrete mixture used is 1-2-4, the sand coming from the shaft as the work progresses. Small gravel, screened from the glacial drift, is used for the rock constituent of the concrete. The mixing is done with a Smith concrete mixer.

The work of construction began October, 1908, and was carried on without interruption during the winter, even though the temperature reached 50 deg. below zero. The shaft was housed and the building heated by steam. The sand was thoroughly heated before using and the concrete mixed with warm water during the cold weather. However, as work progressed it became necessary to have more head room on account of using a larger derrick. Although the shaft is more than 160 ft. deep, not a man has been within 75 ft. of the present bottom, all the work having been done from the surface. The water is controlled by pumps so that it stands 75 to 100 ft. deep all the time. No attempt has been made to pump all the water out.

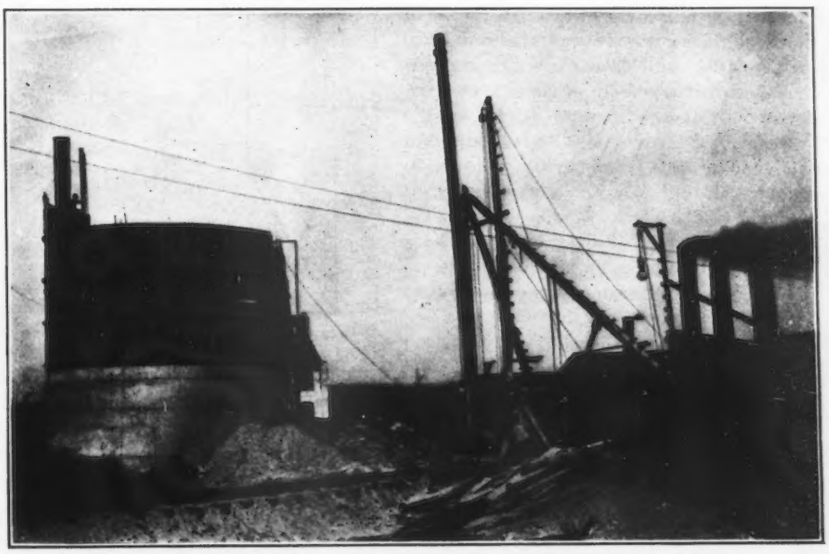
Cutting Edge—A steel cutting edge was made of 1-in. plate, the outer portion being vertical and about 7 ft. high as shown in the accompanying drawing. The inner portion of the cutting edge has a slope or batter of about 35 deg. These two steel shells were reinforced by 4x4-in. angle iron with webs extending from the vertical plate *e* to *f*, which forms the inner plate. This cutting edge was then put in place and the concrete structure begun by filling it with concrete.

Forms—The concrete forms for the outside were made of ⅜-in. sheet steel, 2½ ft. high and reinforced by 4x4-in. angle iron at the top and bottom. Two of these sections were placed one above the other and bolted together so as to make the form 5 ft. high. It required 6 of these double sections to reach entirely around the shaft. The inner sections were of the same width but required only 5 to complete the circle. These were made with 4x4-in. angle iron with 1¾-in. wooden planks placed vertically for lagging. Enough of these sections are made so as to enable the operator to use 3 forms, giving a vertical hight of 15 ft. Each section is fitted with lugs and eyes for handling with the derrick. A set of these forms being placed on the cutting edge, the work of filling in the concrete was not difficult. A 5-ft. form could be put in place and filled with concrete in a 10-hour shift. As one section of the concrete would set, the lower form would be taken off and placed above. By making forms in this manner it was only necessary to make three complete sets, as each one would be used over and over again.

Reinforcing—The reinforcing in this shaft consists of 2 rings of 1-in. square steel bars placed horizontally, one on the inside of the shaft about 1 ft. deep and one on the outside a like distance from the outer circumference, as shown at *c c'*. These rings are placed every 2 ft. the entire length of the structure, as shown by dots *c c'*, vertical section. There are also two rows of vertical reinforcing bars, *a* and *b*, 1 in. square, placed alternately 4 ft. apart.

Water Holes—These are 6 in. square and placed 3 ft. 10 in. apart, as shown. These were formed by nailing together two 6-in. and two 8-in. boards in 5-ft. sections to conform with the hight of the concrete form. The outlet at the lower end *g* was made funnel shape, and is only large enough for a 2-in. pipe to pass through the cutting edge. Through these water ways a 2-in. pipe was inserted which extended any required depth into the sand. Water is forced down under a pressure of 100 lb. per sq.in. at the pump which, with the additional pressure due to head, gives approximately 125 to 140 lb. per sq.in. The object of forcing water down through these pipes is to loosen and remove the sand from under the edge and force it out to the center of the shaft so as to enable the dredge bucket to remove it.

Dredge Well—After the shaft had reached a depth of 85 ft., it was found that the concrete structure was not heavy enough to overcome the skin friction. In order to give it additional weight, a ¾-in.



CONCRETE SHAFT AT HIBBING, SHOWING FORMS AND HOISTING APPARATUS

steel shell 12 ft. in diameter was placed on the inside which gave a 4½-ft. annular space that was filled with 200 tons of pig iron plus sand and water. This well was placed on a cone that had a secure footing on a 4-in. hitch cut into the concrete wall. The bell or funnel part of the shell is reinforced with 4x4-in. angle iron. When the shaft is completed this inner shell will be taken out.

Sinking—All the material was hoisted from the center of the shaft by means of a 1¼-yd. clam-shell bucket, weighing 5400 lb. While the surrounding country contains a large number of granite boulders the shaft did not encounter any that gave trouble. The clay strata as well as the conglomerate had to be broken beneath the cutting edge and this was done by drilling holes below the concrete through the 6-in. water holes with a churn drill. A charge of 5 to 10 sticks of dynamite was used to loosen up the material. The dynamite sticks were broken and put in a tin cartridge 2½ ft. long by 1½ in. in diameter. The lower end was pointed. The cartridge was then attached to a ⅝-in. rod, 6 or 8 ft. long, to give sufficient weight to sink it through the water. The charge was lowered through the 2-in. pipe, and when the bottom was reached, the pipe was withdrawn 10 or 15 ft., and the shot discharged by electricity from a dynamo.

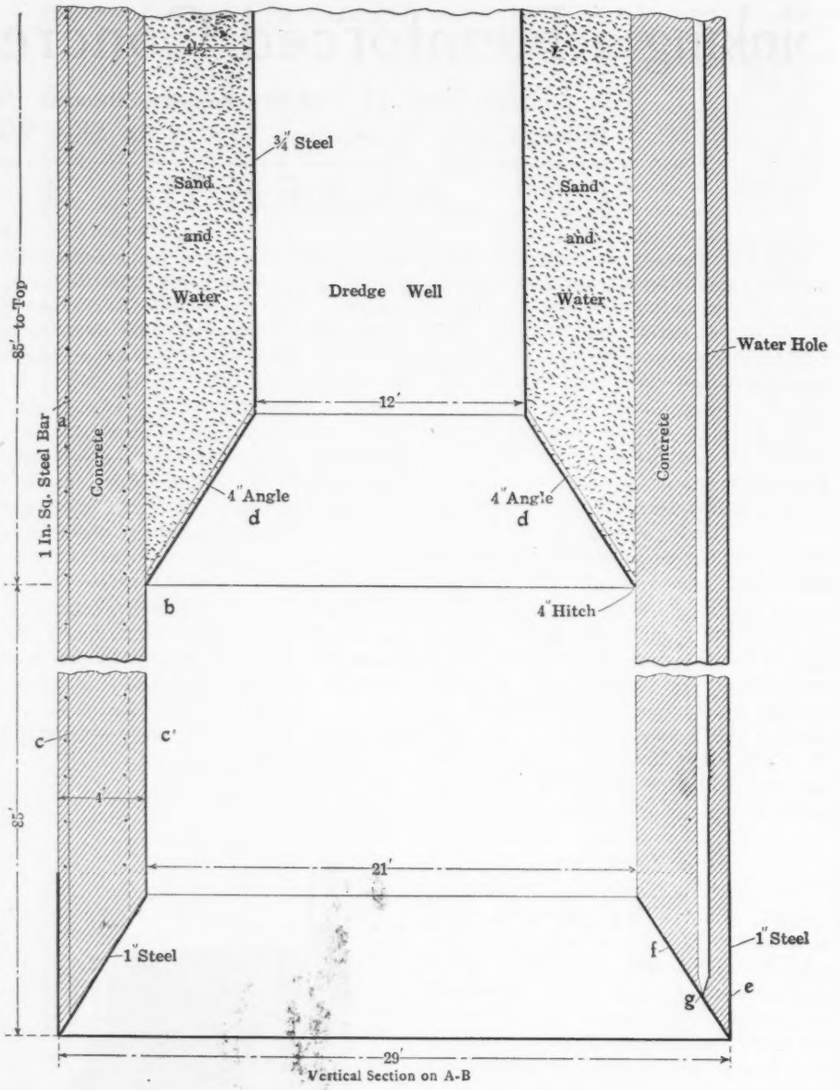
During the progress of excavating the sand and gravel, large cavities formed a number of times on the outside of the concrete wall, which would occasionally result in caving. Two different times the inrush of sand and water due to these cavings forced the water to the top of the concrete shaft which at that time was 40 ft. above the water level. In order to prevent this holing and hanging up, an occasional shot was discharged in the bottom of the shaft.

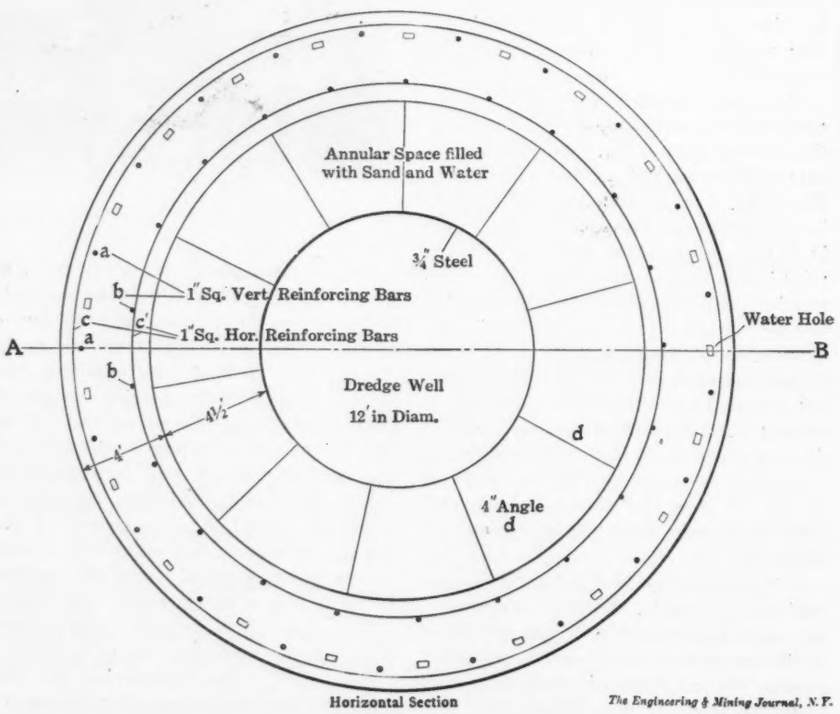
Alinement

Only once during the sinking of the shaft was it actually plumb and this was at about the 80-ft. level. At no time was it out of alinement to exceed 8 or 10 in. This was regulated by cutting more dirt from under the higher side and at the same time adding extra weight. No serious difficulty, however, was encountered along this line. Three times it was necessary to add 1000 tons of sand upon a temporarily constructed platform at the top of the shaft to give sufficient weight to sink. This sand was placed upon and taken off the platform with the clam-shell bucket. In this way the load could be shifted to suit the condition of the ground.

Cost about $500 per Foot

The greatest depth that the concrete structure settled in one 10-hour shift was 3 ft. 10 in. The slowest work was 3 or 4 in. in 10 days. One month averaged 19 in. sinking per day and the work to date





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averages between 6 and 7 in. per 10-hour shift. The contract price for this work is approximately $500 per ft. or about $100,000 for 190 ft. The work of the Foundation Company is to place the concrete shell on solid rock below the water level. The timbering and equipment of the shaft will be done by the mining company. A well equipped power house has already been completed and the mining company will construct a steel headframe as soon as the concrete work in the shaft is finished.

At the present writing the cutting edge is 160 ft. deep, while the concrete shell is a little over 25 ft. above the top of the ground. About all the work that remains to be done is the sinking, as the shaft shell is practically complete. The weight of the structure is about 5000 tons. At least 1000 tons of sand will be placed on top to assist in the final sinking. The boiler plant required is about 125 h.p. A Lidgerwood 10x12-in. engine is used for hoisting.

This same company has a contract for sinking a shaft on the Scranton mine, at Hibbing, through 150 ft. of similar material. This shaft will be 29 ft. outside diameter with a rectangular opening 9x17 ft. This will give about double the weight of concrete, and the structure should sink more readily.

I am indebted to J. C. Fox, superintendent of the Foundation Company's work, for the above information.

The Metallurgical Behavior of Barium Sulphate

According to W. Mostowitsch, in *Metallurgie*, 1909, VI, 450-467 (through *Journ.* Soc. Chem. Ind. of Aug. 31, 1909), pure barium sulphate can be heated in pure, dry air for 15 to 30 minutes at 1400 deg. C. without decomposition; at 1500 deg. it begins to dissociate to a small extent. When heated rapidly, it melts at 1580 deg., with partial decomposition into barium oxide, sulphur dioxide, and oxygen. Barium sulphate is decomposed by both silica and ferric oxide at 1000 deg. The sesqui-, bi-, and tri-silicate mixture sinter at 1350 deg., and fuse at 1400 deg. C.; the melted mass contains undecomposed barium sulphate in solution. The degree of decomposition increases with the temperature and the proportion of silica present. The behavior of mixtures of barium sulphate with one, two, and three molecular proportions of ferric oxide is similar, the sintering and melting-points being the same, but far more ferric oxide than silica is required to effect the same degree of decomposition; the ferrites formed, are thin liquids, solidifying to crystalline masses; they are capable of dissolving both barium sulphate and ferric oxide.

The reduction of barium sulphate by carbon, begins at 600 deg. and is practically complete at 800 deg. C. With carbon monoxide, reduction begins at 650 deg. and is nearly complete at 800 deg. C. When heated to 1200 deg. in an atmosphere of carbon monoxide, the barium sulphide formed loses a small proportion of its sulphur. The decomposition of barium sulphate into barium oxide, sulphur dioxide, and oxygen involves the absorption of a large quantity of heat (136,740 calories), and this may occasionally be useful in lowering the temperature of the slag in the converter treatment of lead and copper.

Slags containing barium are very liquid, but specifically heavy. Such slags are able to dissolve iron from copper matte. When heated in a reducing atmosphere, barium sulphate is readily reduced to sulphide, which has a strong tendency to enter the matte; a matte containing 35 per cent. of barium has been obtained. Barium sulphide apparently tends to carry the noble metals into the matte.

The Purchase of Lead Ore in Derbyshire, England

The primitive methods of mining and for the sale and purchase of ores that formerly characterized the Joplin district of Missouri and Kansas and still exist there to some extent are by no means confined to that region. An article by H. L. Terry in the *Min Journ.* of Aug. 14, 1909, contains an account of the method of effecting transactions in the Peak district of Derbyshire which presents some interesting features of similarity.

A special feature of Derbyshire mining is the small scale on which many of the mines are worked. Two men, or a man and a boy, often comprise the whole personnel, the larger partnerships of old days not being now met with. The usual plant consists of a bucking stone, a hand crusher, a Derbyshire jig, and, in some cases, a flat buddle. More often than not the mines are at elevations where there is no water supply, and what is stored in the large tub is used over and over again in the dressing operations. Though the hand crusher still survives, the horse crusher, which is of quite a different type, is only to be met with in a ruined condition at abandoned mines.

Sales of ore at these mines are usually effected on what would be considered elsewhere rather insignificant quantities, less than half a-ton in fact often changing hands. The procedure is as follows: The miner informs one of the two smelting works in the country that he has ore to sell, and a day is arranged to bring off the deal, the barmaster having three days' notice given him to attend. On the day agreed upon the smelter's agent and the barmaster go to the mine, and the ore is measured in the standard "dish" which the latter brings with him. The total number of dishes being known, the dish full of ore is weighed on the barmaster's portable scales. The tare having been subtracted, the weight of the ore forms the basis by which the value of the ore is arrived at by the smelter's agent. The somewhat abstruse calculation having been made, the barmaster deducts the royalties, and in some cases a tithe, and the rest of the cash is handed over to the miner, who, during the proceedings, has remained mute, but inwardly consumed with anxiety as to the outcome of several weeks' hard labor. When the money he receives is much less than he expected explosive language may disturb the previously existing calm, though the officials do not allow such ebullitions to upset their equanimity.

Assaying does not enter into the transaction. The miner knows nothing about the percentage of lead in his ore, but the buyer estimates it by the weight of the dish, the degree of accuracy with which this is done being a point which might conceivably lead to the expression of different views were it made a subject of discussion. The ore is removed from the mine by the smelter, and reweighed at its destination, which is either the Brough lead work, near Bradwell, or the Lea lead works, near Matlock Bath. It is probably a safe assumption that the buying and selling of lead ore in Derbyshire is unique at the present day, but there is general agreement that it works very well considering the local conditions. The smelters never refuse to purchase a lot of ore of however small dimensions, or to send a cart to rather inaccessible places to take it away. In the absence of these facilities for disposal of the ore, the working miner, without capital resources or office equipment, would doubtless find it even harder work to pay his way than is at present the case under the discouraging market conditions of to-day.

Queensland began its independent existence Dec. 10, 1859, and in 1867 gold was discovered in the Gympie region which, up to the end of 1908, had produced £10,350,000 worth of gold (*Queen. Govt. Min. Journ.*, July 15, 1909). The other notable gold-producing localities, the date of their discovery and their outputs to the beginning of 1909, respectively, are: Ravenswood, about 1868, £3,096,600; Etheridge and Woolgar fields, 1869, £2,177,385; Charters Towers, about 1870, £24,600,000; Palmer, 1873, £5,629,228; Hodgkinson, 1875, £975,728; Mount Morgan mine, 1882, £15,260,000 (gold and copper); Croydon, 1886, £3,031,157; total, 16,076,862 oz., valued at £68,290,083. The Mount Morgan mine has returned £7,230,000 in dividends besides paying out for wages, etc., about £7,000,000.

Flue Construction and the Saving of Flue Dust

By J. B. Wynne*

To all lead smelters the fume question is of prime importance. Escaping fume means direct expense by loss of metal and indirect expense by possible payments of compensation to surrounding landowners. More especially is this the case in Europe, where of late years the strong competition for ores has reduced the returning charges to a point where the margin of possible profit is so small that it disappears altogether for such works as cannot recover nearly 100 per cent. of the metal values contained in the ore smelted, and where the factory inspector is becoming more and more exacting each year. These causes have led to much work being done of late in improving old methods of catching fume and in developing new ones.

Most of these new methods consist in passing the furnace gases through a more or less complicated system of water sprayers, and the fundamental idea is, that the fume will be caught by the particles of water and carried down to be recovered in suitable settling tanks, filters, etc.

Difficulty of Wetting Fume

Anyone who is acquainted with the physical properties of fume, and who takes the trouble to think the matter out, will soon see that this method can never be successful. Every lead smelter knows how difficult it is to wet flue dust when it comes fresh and powdery from the flue. If, for instance, a bucketful of water is thrown on a heap of fresh fume, a cloud of dust rises and only an infinitesimal amount will be carried away in the water as it runs off the heap. Exactly the same thing happens in the spraying chambers. There the heap of dust and the bucketful of water are replaced by a particle of fume and a minute drop of water, or rather by an atmosphere full of infinitely small fume particles into which is discharged a stream of minute drops of water; for no matter how efficient the sprayer may be the water still remains in the form of drops. Some of the fume particles will be struck by the water, but, having no mutual affinity, the fume particle will be pushed aside and the water will pass on, just as when poured from the bucket upon the heap of dust.

In this way the spraying process fails because of the great difficulty which exists in wetting dry fume. On the other hand, when once the fume is moistened it is readily absorbed by water, and only by paying due attention to these facts can a satisfactory result be expected from a wet-fume collector.

Choosing a Fume-Catching Plant.

When the Silberhütte smeltery decided to put up a fume-catching plant, four systems were considered: (1) Increased length of flue; (2) bag house; (3) mechanical dry filters (System Frichter); (4) wet method. The first system was discarded as inefficient, the second and third as too expensive, and it was resolved to erect a spraying machine.

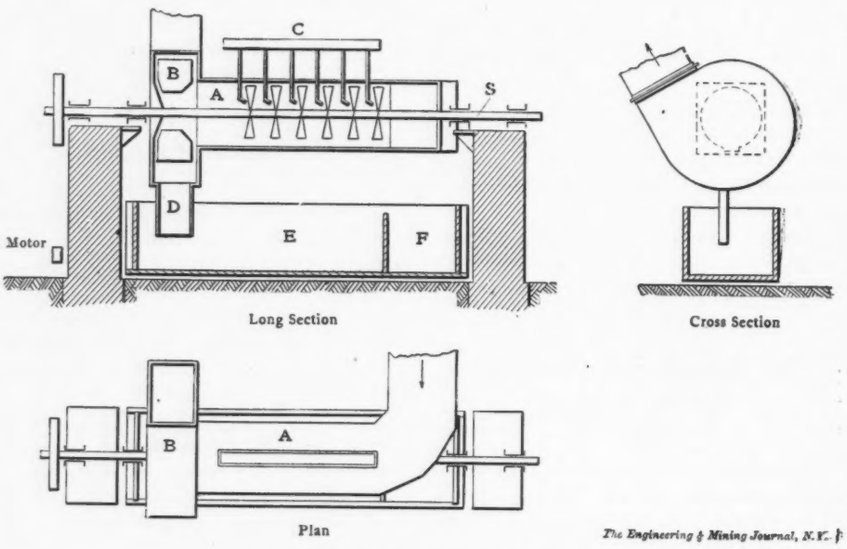
The "Theissen" wet scrubber so largely used in cleaning iron blast-furnace gas was first considered. It is a very efficient machine, but absorbs considerable power. This is immaterial to an iron works where almost unlimited power is a by-product, but for other works it is an item which cannot be overlooked and in this particular case it put the Theissen scrubber out of the question. A special machine had therefore to be designed to suit the conditions of a lead smeltery, and, with a minimum expenditure of power, obtain a maximum recovery of dust. The working theory on which this machine was designed is perhaps not original, but is probably novel enough in its application to lead smelter fume to be of general interest.

Designing the Plant

Starting from the facts given above, it was clear that good results could be expected from a wet collector only when the fume was moistened before entering it. The question then arose: How could the fume be most efficiently moistened? If a vapor be cooled down below its "dew point," it condenses to a mist of minute particles of liquid which further combine and fall finally as small drops. If any solid particles, such as dust, are present in the vapor they form "nuclei" on which the vapor, as it cools, rapidly condenses, so that any dust atom present is soon inclosed in a drop of liquid. It seemed, therefore, probable that good results would be obtained by introducing into the dusty furnace-gases a sufficient amount of dry steam (water in the true gaseous state, in which state it mixes rapidly and intimately with any other gas), and cooling the mixture to below 100 deg. C. before it entered the sprayer.

Description of Apparatus Adopted

To this end a small centrifugal spraying nozzle was inserted in the flue directly behind each furnace where the gases were sufficiently hot to vaporize the sprayed water to a truly gaseous condition. In this way an intimate mixture of dry steam and furnace gas was obtained.



GENERAL ARRANGEMENT OF FUME COLLECTOR

About 25 yd. behind the furnaces in the main flue, a larger sprayer was installed as a cooler, and 50 yd. behind this, where the temperature of the gas had fallen to between 70 and 90 deg. C., the fume collector was built. The general arrangement is shown by an accompanying sketch. The fan, *B*, draws the gas and moistened fume from the main flue into *A*, a rectangular box of 1 m. square section. On a shaft, *S*, revolving in this box are keyed 6 propeller fan-wheels upon each of which a 1½-in. gas pipe delivers water from a distributing launder, *C*. The water falling on the propeller blades is thrown out radially, forming a curtain of spray through which the gas must pass. The box, *A*, has a slight fall toward the fan, *B*, which is also keyed on the shaft, *S*, and draws directly from *A*, so that the water collecting on the bottom of the box flows to *B*, where some of it is caught by the fan wheel and is again

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mixed with the gas, finally falling to the bottom of the fan, housing and passing through the channel, *D*, into the collecting tank, *E*.

This tank is sufficiently large to allow most of the absorbed dust to settle out. It is built of wood and is divided by a partition-wall into two unequal parts in the larger of which, near the inflow, *D*, the fume settles down as pulp. The partially cleaned water overflows into compartment *F*, and from there is drawn off by a centrifugal pump and, after passing over a cooling tower, returns to the distributing launder, *C*. A plunger pump, drawing from *E*, passes the pulp through a suitably placed filter press from which the filter cakes fall into a trench and are trammed away, the clear water returning to *F*. Only a small amount of fresh water is required to make up for leakage and evaporation. This is added to launder, *C*.

Water Should be Kept Neutral

In order to prevent the water becoming acid and corroding the shaft, fan-blades, etc., two or three bucketfuls of slacked lime mixed with water to a thick soup are added daily. This not only corrects the acidity but acts as a binder in the filter press, which may be looked upon as combining the functions of filter and briquetting machine. The circulating water should be tested regularly with congo paper and always kept neutral. The filter cakes are firm and contain, on an average, 70 per cent. Pb and Sb in the dried state, and fall from the press with about 15 per cent. moisture. The high percentage of metal in the presscakes is remarkable and not easily explained, as the average metal content of the dust caught in the flue is 55 per cent

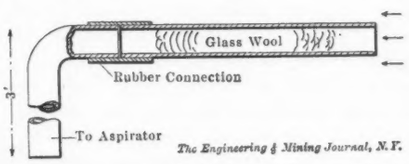
The housing of the apparatus is of wood and the fan blades of 3 mm. sheet iron. If the circulating water is kept neutral by the regular addition of lime, corrosion need not be feared. The plant is electrically driven and the power required, including filter pump, circulating pump, shafting, etc., is 17 h.p. The estimated volume of gas treated is 300 cu.m. per minute.

The results of many tests showed that nearly 50 per cent. of the total dust content of the gas was caught in the apparatus, and in addition to this over 30 per cent. was caught in the flue, so that, in all, 80 per cent. of the total dust content of the gas was recovered. It should be mentioned here that the total length of flue at Silberhütte is less than 300 m.

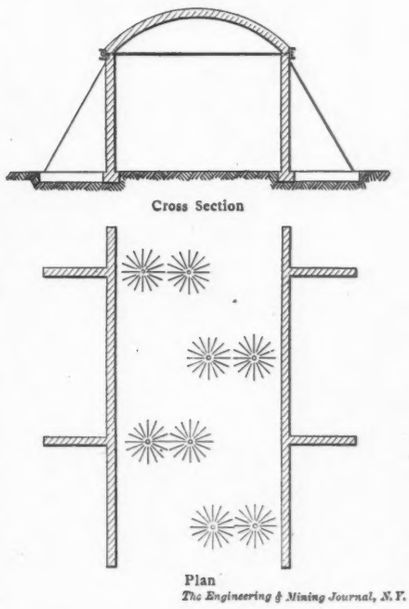
Method of Testing

As the apparent results depend so largely on the accuracy of the tests made, it may be well to describe the method adopted in determining the quantity of solid matter contained in the gas.

A piece of glass tubing, 4 in. long and ⅜ in. internal diameter, was filled with glass wool, leaving about ½ in. free at each end. The whole was thoroughly dried, well shaken to remove any bits of glass wool that might be loose, and finally weighed. Enough dusty gas was then drawn through this filter to deposit about 50 mg. solid matter, the volume of gas and the increase of weight being noted. In making a test, the weighed filter-tube was attached by a short piece of rubber pipe to another glass tube, 2½ to 3 ft. long, bent at right angles at one end, so that when inserted in the flue the filter tube should take a position parallel to the flow of the gas, and with the open end facing the draft. A carboy,



APPARATUS FOR TESTING GAS



ACID PROOF FLUE

carefully sealed and fitted with syphon to draw off the measured quantity of water, acted as aspirator. By placing the filter at the inflow end of the aspirator pipe instead of drawing the gas first through a sample tube, all losses of dust due to adhesion to the walls of the tube before reaching the filter were eliminated. After slowly drawing sufficient gas through the filter it is removed from the flue, any dust adhering to the outside carefully wiped off, and the whole dried and weighed. The increase of weight gives the amount of solid matter contained in the volume of gas filtered. Tests taken in this way gave very consistent results.

Construction of Acid Proof Flue

It had been originally proposed to build a large wooden chamber directly behind the fume collector to act as a settling tank in which any dust particles that had escaped the spray should have time to absorb further moisture out of the saturated gases and become heavy enough to fall down. The necessary concession for this building was, however, not granted, on account of the supposed danger of fire. As the gases left the fume collector with a temperature of 50 to 60 deg. C., and were, moreover, saturated with water vapor, this danger was not very real. It was expected that the gas would have had time to deposit most of its excess moisture while passing through the chamber, so that, on reentering the flue, it would not contain an amount of water injurious to the masonry. However, as the settling chamber could not be erected at once and in consequence very wet gases were to be expected, a special acid-proof flue was designed and built. This flue is in every way most satisfactory and may be expected to last an almost unlimited time under conditions most trying to ordinary construction.

The flue is 2.50 m. wide by 2.20 m. high, measuring to the springing of the arch which forms the roof. The walls, as well as the arch, are of ordinary red brick laid in tar mortar and are built half a brick thick (4½ in.). The walls are strengthened with buttresses, also built of half a brick in thickness, placed every 2.5 m. The arch of the roof abuts on either side against a channel iron, 12 cm. high, running the whole length of the flue, and the thrust is taken up by ⅞ in. tie rods spaced 1.25 m. apart, which hold the two channel irons in place. As these tie rods have to pass through the gases and would soon be corroded by the acid vapors, they are protected by running them through a length of 1 in. lead pipe. The length of the pipe is such that when the tie rods are tightened up in place, the ends of the lead pipe are forced into close contact with the channel irons, and the whole is well bedded in tar mortar so that the iron is thoroughly protected.

Tar Mortar Used

The mortar is made of fine clean quartz sand and well boiled tar. Sand is stirred into the tar while it is still in the boiling pot, in sufficient quantity to bring the mixture to the consistency of ordinary lime mortar. It must be used hot as it thickens on cooling. The tar must be thoroughly boiled to drive off the contained water; the sand also must be dry, otherwise the mortar will set badly. Even after boiling, the mortar sets very slowly but finally becomes extremenly hard, so that in pulling down old walls built with this mortar the bricks often break before the mortar gives way.

The flue is painted on the inside with tar thickened with pitch, and the roof on the outside is given several coats till a good surface is obtained which throws off all rain and protects the two channel irons. The buttresses outside the flue are built with cement mortar.

LOW COST OF CONSTRUCTION AND MAINTENANCES

The first cost of a flue of this type is not great and if the durability and absence of repairs is taken into consideration it will probably be found to be cheaper than almost any other type. At Silberhütte, where the building site necessitated heavy casting, the cost per meter run came to very little over 100 marks (about $25). The walls, being very thin, require a minimum of building material, and greatly assist in cooling the gases, which tends to good recovery of fume. As far as the labor cost is concerned, when once the masons have grown accustomed to working with tar mortar, the building progresses as rapidly as with ordinary lime mortar.

Baffles have been used to good advantage in the flue at Silberhütte. Spruce trees of suitable size placed alternately on either side of the flue as indicated in the plan, give excellent results and are very cheap. They can, of course, be used only in connection with a wet sprayer, as otherwise they would soon be burned.

The above described system of fume saving is capable of considerable development and promises good results. At the same time the cost of installation is not very great and the power and attendance required are moderate.

The problem of economic fume saving is not easily solved and the solution can only be reached by practical trial. No doubt many smelters have made trials in various directions but unfortunately the results are seldom, if ever, published. Experience is a dear school and it is a pity when knowledge, even of a negative kind, which has been gained through the expenditure of much thought and cash, is lost. The whole smelting world would surely benefit if the work done in this direction by individuals were made public so that new workers in this field might take up the problem where others left it, and not have to start from the beginning. This article is written in the hope that it may be of use to some, and may induce others to add their experience to the general stock for the general good.

The manufacture of calcium cyanamide is now carried on in 13 works in Europe, viz., Notre Dame de Briançon, France; Martigny, Switzerland; Odda, Norway; Muhlthal, Trostberg, Westeregeln, Brühl, Knapsak, in Germany; Piano d'Orte, Terni, St. Marcel, in Italy; Sebenic in Dalmatia, and Fiume in Austria.

Contributions to the Chemistry of Zinc Smelting*

Experiments are described in which pure zinc sulphide was roasted alone, with ferric oxide, with calcium carbonate, and with a mixture of iron sulphide and calcium carbonate in porcelain crucibles of 10-c.c. capacity, by the flame of a Teclu burner at a temperature of 850-950 deg. C. The residue was analyzed and the loss in weight determined, the results being tabulated after calculation in percentages of the original amount of substance used. The results show that: (1) Pure zinc sulphide can be roasted completely to the oxide if the conditions are such that the zinc sulphate produced is again decomposed. (2) Incomplete removal of sulphur is due to incomplete decomposition of the sulphate. Iron oxide influences this by reacting with the zinc sulphide forming ferrous sulphide. Calcium carbonate does not prevent the complete roasting of the zinc sulphide, but forms calcium sulphate.

Experiments on reduction were carried out in covered graphite crucibles in a muffle heated to 1300-1400 deg. C. for 14 hours, when the crucible was allowed to cool in the closed muffle, and its loss in weight determined, the results being calculated and tabulated as before. It is shown that calcium sulphate and carbon do not quantitatively react according to the equation

$$CaSO_4 + 4\ C = CaS + 4\ CO.$$

Part of the calcium sulphide produced appears to react with the sulphate according to the equation,

$$3\ CaSO_4 + CaS = 4\ CaO + 4\ SO_2.$$

Zinc sulphide appears to be volatile, since zinc and sulphur are lost in atomic proportions. Iron sulphide is more readily reduced by carbon than zinc sulphide. Ferric oxide, zinc sulphide and carbon yield carbon monoxide and bisulphide, iron sulphide, and the metals iron and zinc, with some reproduced zinc sulphide.

In the technical roasting of zinc sulphide ores it is concluded that the iron present in the blende is to a slight extent harmful during the roasting because it prevents the complete oxidation of the zinc sulphide. In the distillation process iron is useful if present as ferric oxide (1) because during the roasting it converts zinc sulphide into zinc oxide which is then available for réduction; (2) because if calcium sulphate be present, ferric oxide retains the sulphur as iron sulphide, and prevents the zinc forming zinc sulphide. In preparing the mixture for the retort in case the blende contains much calcium, it is advisable to add ferric oxide in order to obtain a better yield of zinc. Of course, it is advisable to remove the calcium salts after roasting, preferably by washing; if this were done, the roasted blende would be as easily distilled as a calciferous calamine, since in the absence of calcium sulphate the small amount of ferric oxide usually present in the mineral would be sufficient to convert unroasted zinc sulphide into zinc oxide.

*Abstract of an article by V. Lepiarczyk in *Metallurgie*, 1909, Vol. 6, pp. 409-419, through *Journ.* Soc. Chem. Ind., Aug. 16, 1909.

Metallurgical Practice on the Rand

According to Lionel Phillips, chairman of the Transvaal Chamber of Mines, the main feature of 1908, was the increase in duty per stamp. The factors responsible for this are the introduction of heavier stamps in new mills, and the weighting up of the existing stamps accompanied by the use of coarser meshes. In each case subsequent tube milling has been used to produce the necessary fineness for extracting the gold by cyanide.

In tube milling, the only advance has been the general adoption of reef in place of pebbles for the grinding load, which has effected a considerable saving. Practically no liners are now imported, and requirements in this respect have been drawn from local sources. The ribbed iron liner is being tried on several mines, and affords promise of being very successful. Classification of sand fed to the tube mills has advanced considerably, both in respect of dewatering and separation of the already fine material.

In cyanide treatment there have been no innovations, attention being concentrated upon making best use of plant capacity. Mr. Caldecott has introduced a new method of collecting sands, which is yet in its infancy, but is doing good work on the Simmer Deep. In slime treatment, the Adair-Usher process has been installed on a few more plants. A modification of the Brown agitator has been successfully adopted for the aëration and sweetening of accumulated slimes, and it is probable that its use will be extended for that purpose.

The utilization of waste heat for warming cyanide solutions has met with much success, and effected a saving in plant required in slimes treatment. Many metallurgists believe that amalgamation plates can be dispensed with, and the whole of the free gold recovered by direct cyanide treatment. A further experiment in this connection on a practical scale will shortly take place. If successful, the opportunities for gold stealing would be much reduced, and a reduction in size of future plants effected.

In ordinary patio work an average extraction of from 85 to 90 per cent. of the silver and from *nil* to 25 per cent. of the gold content of the ores may be counted upon.

Unloading Railroad Cars by Machinery

Mechanical Dumping Device That Handles Total Weight of 255,000 lb.; One Machine Unloaded 265 Freight Cars in Twelve Hours

BY SNOWDEN B. REDFIELD

If railroad cars can be loaded by machinery, why cannot they be unloaded by machinery?

Loading coal and ore into gondola freight cars has been done by machinery for a long time, for we are all familiar with the conveyer and elevator, and the coal chute is among the oldest inhabitants of almost every railroad yard.

Not very long ago the laborer with the shovel for unloading ore and coal cars was partially put out of business by the introduction of the hopper-bottom gondola car. It might almost be said that the hopper-bottom car marked the dawning of a new epoch in the rapid unloading of coal and ore trains, for theoretically all that had to be done was to run a long train of these hopper-bottom cars up on a trestle, then to open the doors on all the cars and have their contents drop out onto the piles below the trestle.

This sounds very well, but in actual practice it has been found that the process is slow and that the laborer has invariably to be sent into the car to assist the material out through the bottom door. In the case of freezing in winter the coal and ore have to be dug out with a pick as well as a shovel, and the process is anything but rapid.

Picks Car up and Dumps It

Again came the question, if cars can be loaded by machinery why cannot they be unloaded by machinery? The accompanying illustrations show one of a pair of car-dumping machines built by the McMyler Manufacturing Company, of Cleveland, and operated on the Hoboken, N. J., docks of the Delaware, Lackawanna & Western Railroad Company. Each one of these machines is capable of picking up and turning almost bottom side up any gondola freight car now in existence or liable to be designed for some time to come. This machine picks up the car, carries it upward to a convenient hight, and there literally turns it over almost completely bottom side up, dumping its load down into a funnel-like apron, which directs the material through a chute into a barge underneath, alongside the dock. The material handled at Hoboken is coal, and it is by these machines that the Delaware, Lackawanna & Western Railroad Company transfers its coal from rail to barge transportation.

FIG. 1. MCMYLER CAR DUMPER AT HOBOKEN DOCKS OF THE DELAWARE, LACKAWANNA AND WESTERN RAILROAD COMPANY

Fig. 1 is a general view of the north machine, and it will be seen that up in the center of the structure there is a steel hopper-bottom railroad car almost upside down which has just dumped its load of coal down upon the apron and chute leading into the canal boat alongside the dock. The impression given by the illustration is that this car-dumping machine is an affair of some size, and this impression is quite correct, for it is designed to pick up a car which will hold a load of 120,000 lb.,

NOTE—Reprint from *American Machinist*, Aug. 19, 1909.

which, together with 50,000 lb. for the weight of the car, 85,000 lb. for the weight of the track and cradle which holds the car, makes a total weight lifted of 255,000 pounds.

The record unloading obtained by the Delaware, Lackawanna & Western Company with one machine was 265 cars in 12 hours, and during the month of March just past they handled 325,000 tons of coal on the two machines. As a matter of fact the capacity of a machine of this kind is limited by the kind of coal and by the rapidity with which boats can be pulled into place, one after the other as they are loaded.

Here are some records obtained from a similar machine at Toledo: 336 cars were handled by this one machine in a day, presumably 12 hours. Three hundred and twenty-six cars were handled by the same machine between 6:30 a.m. and 4:35 p.m., with 25 min. lost time waiting for boats. In these 326 cars there were 11,584 tons of coal. Another record is 206 cars holding 6390 tons of coal, unloaded in five hours. The average run for one machine at Hoboken is about 22 to 25 cars per hour; but one record of 42 cars in an hour was obtained on the machine at Toledo.

Operation of Contrivance

Cars are brought to the dumping machine up an incline, being pushed into place by a small steel car of peculiar shape and designed to push the gondola car up the hill by means of a cable which stretches up the track. The pushing car is of narrower gage than the standard railroad car and consequently there are four rails on the incline. This is illustrated very clearly in Fig. 2.

The pushing car is called by various names, depending upon the locality of its use. In western Pennsylvania, among the coal mines, where one of the principal means of locomotion is the old-fashioned mule, the pushing car is known as a mule. On the Delaware, Lackawanna & Western docks at Hoboken they call it a hog, or pig.

At Hoboken all the power to run the machine, as well as the pig, is obtained from steam, and the canal boats which lie alongside the dock are pulled into place by cables actuated by steam engines on the dock.

After the pig has pushed the car up into the cradle of the car dumper the cradle begins to rise, lifting the car but without turning it over. The cradle may best be described as a long platform carrying a section of the railroad track. On one side of this platform, that is the side next to the water, or the dumping side, there is a vertical steel wall extending up from the platform. The section of track in the cradle is mounted on rollers in the cradle itself in such a way that the track may slide over about 10 in. toward the dumping side.

From this sliding track there extend four heavy chains, which run horizontally from the track toward the water, then around four sheaves in the cradle, and then upward to the extreme top of the machine, where they again pass around slanting side of the machine to four sliding counterweights. The effect of these other sheaves, and finally down on the counterweights and chains is to continually tend to draw the section of track over toward the dumping side of the platform; that is, toward the vertical wall. When the platform or cradle is in its extreme lowest position the section of track is, however, held over to the opposite side in continuation with the rails leading up the inclined plane. This holding is done by two rocker arms, which, when the cradle is at its bottom position, rest upon blocks underneath.

Fig. 1 is from a photograph taken from a position half way up the structure, and looking down at the bottom of the cradle while it is in the act of dumping a steel gondola car over toward the right-hand side of the picture. The two rocker arms and their connecting shaft are clearly shown on the bottom of the cradle. The rocker arms are also shown in Fig. 4.

As soon as the cradle has been lifted sufficiently far to relieve the rocker arms from the blocks upon which they rest, the counterweights with their chains draw the track and the car over toward the vertical wall on the dumping side of the cradle. This makes the car rest firmly against the upright wall of the cradle.

As the car further rises, four large steel hooks, which up to this time have been standing over but not touching the car, begin to drop down, and finally hook over one side of the car. These hooks are also on the dumping side. The car continues to rise, still maintaining its normal upright position, but pressed against the side wall of the cradle.

FIG. 2. PUSHING THE CAR UP INTO THE CRADLE

FIG. 3. TURNING THE CRADLE AND CAR

Turns Cars Over

After the cradle has been lifted so far that the top edge of the upright side strikes against the hinge of the swinging funnel-shaped apron, the whole cradle begins to turn over by revolving about these hinges, causing the car to lean still harder against the upright side of the cradle. This is shown in Fig. 3 where the car is partially turned over. The turning action will be understood when it is said that the hoisting cables coming from the engine house, shown at the bottom left side of Fig. 4, after going to the top of the tower, come down again, pass under sheaves *A* at each end of the cradle at the lower left corners, as viewed in Fig. 4, before turning. From these sheaves the cables pass under the cradle to the sheaves *B*, shown at the lower right-hand corner of the cradle and from thence up the vertical side to other sheaves *C*, located on the under side of the apron. Passing around these latter sheaves the cables once more go downward and finally fasten onto the cradle itself.

It will be understood now that when the hoisting cable is drawn in by the hoisting engine the tendency is at first to lift the whole cradle in its normal upright position, but when the upper edge of the side wall of the cradle strikes upon the hinge of the apron already spoken of, it is easily seen that to continue to draw in the cable will cant the cradle over in a clockwise direction as seen in Fig. 4.

Cars Held Firmly

As the cradle tips over, the chains leading up the right-hand side wall of the cradle, being drawn taut by the counterweights and holding the track and car strongly toward the vertical wall, begin to wind over the top of the car. It is now that the real use for the hooks already spoken of is seen, for the chains are inside of the hooks, and as the car tips and the chains begin to wrap around, these hooks protect the side wall of the car from being crumpled in by the powerful pull of the chains. Fig. 5 is a view looking down upon the overturned car, and the four counterweight chains wrapping around the car are plainly seen. This action, which is also shown in Fig. 4, in dotted lines, clearly illustrates how the car is prevented from falling out, as it is literally bound into the cradle by these chains and their counterweights.

In Fig. 5, at the left, three smaller I-beams will be seen to be projecting through the sides of the heavy plate girder of the main cradle. It is upon these I-beams that the section of track rests, and they are mounted upon rollers in the cradle itself, as already described. In the position shown in Fig. 5 these I-beams are drawn down to their extreme position, as the track is held strongly over toward the dumping side of the cradle by the action of the chains and counterweights.

No Slack in the Barge

The coal in passing out of the car and down into the funnel-shaped apron, passes over a screen in the bottom of the apron. By means of this screen the slack and fine coal is separated from the larger sizes, which it is desired to load into the barge underneath. The mesh of this screen is adjustable by means of handwheels, and these wheels may be seen on the far side of the apron in Fig. 5.

Below the screen, that is in the pocket under the screen, there is a worm conveyer driven by a motor, which constantly traverses the slack and fine coal to the farther end, where it drops down a chute into a bucket conveyer, which carries it up into a bin in the building shown in the background of Fig. 5. Here the amount of slack is weighed and may then be dumped into other cars and carried off to the power houses, where it is burned under the boilers.

In this way, knowing the weight of a car of coal, the net weight of the car and the amount of slack separated out from the coal in the act of dumping, the net weight of coal actually transferred to the barge is known, and the coal actually loaded into the barge is of the proper size, as desired. For fine coal, which is not screened, the gratings are covered with steel plates and the dumping may be done very much more quickly than when dumping stove or egg coal, for in this latter case the coal must be dumped at such a speed that there will be sufficient time for the screening to take place effectively.

Fig. 6 is a view of the apron and its chute which delivers the coal into the barge. In the upper left-hand corner of the picture are the motor and gear driving the worm conveyer, and also the vertical chute is seen at the far end, which carries away the slack coal from the screen.

Unloads Where Desired

On the extension arm of the apron, overhanging the water, there is a protected platform where an operator controls a number of electric switches and hoists. By means of various motors and the cables shown leading downward from this platform the chute at the outer end of the apron may be raised or lowered, or turned inward or outward, with respect to the dock. Also the operator on this platform has control of a sliding gate at the apex of the funnel of the apron, so that he can almost instantly shut off the supply of coal passing through the chute down into the barge. In this way the coal may be loaded into the vessel in piles so placed as to balance the barge with considerable facility. As surmised, the apron itself may be raised and lowered on its outer end so as to give it more or less slant, depending upon the rapidity with which it is desired to pass the coal over the screen.

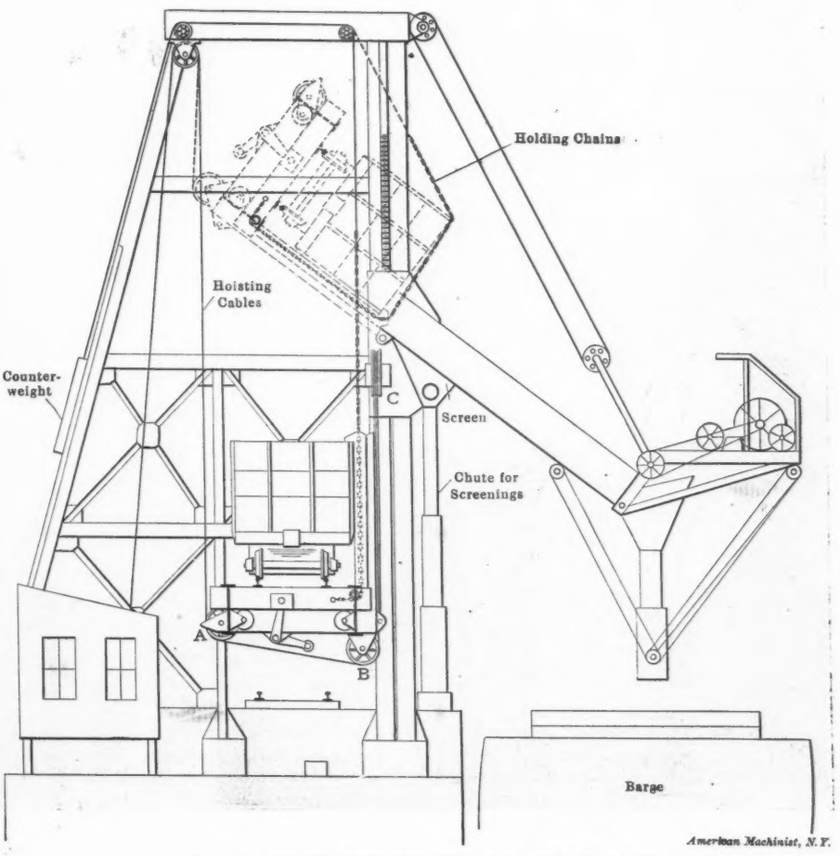


FIG. 4. SKETCH SHOWING OPERATION OF UNLOADER

ADJUSTABLE TO ACCOMMODATE VARYING CONDITIONS

There is another adjustment for this apron, that is, a vertical rising and falling at the hinged upper end. In the exact center of Fig. 5, beyond the far end of the car, will be seen a vertical screw which is about 4 in. in diameter. This screw passes through a nut near the hinge of the apron, and by turning the screw and its mate at the near end, the vertical elevation of the whole apron may be adjusted. This adjustment in the machines at Hoboken amounts to 30 ft.; that is, the car turning in its highest position turns about 30 ft. higher than in its lowest turning position. The object of this adjustment is to accommodate the various hights of barges and ships to be loaded.

No matter how high or low the hinged end of the apron may be, the rising cradle always strikes against the hinge when it has been lifted sufficiently far, and begins to turn at this point, so that the side of the inverted car practically coincides with the bottom surface of the apron. The size of the car also, within wide limits, is immaterial as the sliding track and hooks and chains automatically adjust themselves to each condition.

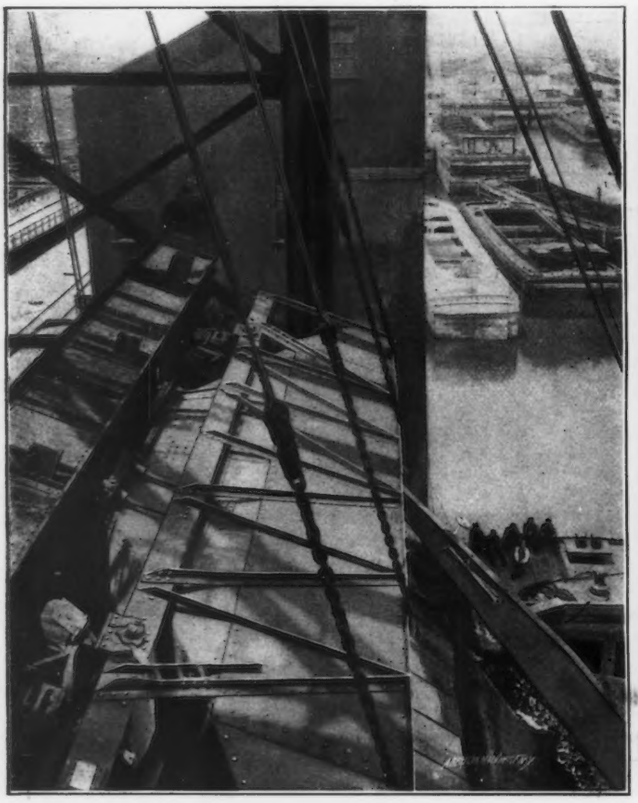


FIG. 5. DUMPING THE CAR, SHOWING THE COUNTERWEIGHTED HOLDING CHAINS

FIG. 6. THE APRON AND CHUTE WITH BARGES BENEATH

Working costs at the Dolcoath mine, Cornwall, for the past half year were (*Min. Journ.*, Aug. 21, 1909) 29s. 2¼d. per ton.

Methods for Assaying in Cyanide Plants*

In addition to the ordinary fire assays for silver and gold the assayer of a cyanide plant is called upon to determine the alkalinity of the solutions, the consumption of alkali by the ores, the strength of the solutions in potassium cyanide at various stages of the operations and the amounts of silver and gold held by the solutions.

Alkalinity—A standard solution of sulphuric acid is made so that 1 c.c. of it will equal 1 c.c. of a solution of caustic soda with 0.04 gm. of NaOH to the c.c. This is accomplished by dissolving 30 c.c. of concentrated sulphuric acid in a measured amount of a water, say, 900 c.c., and then standardizing it with 0.53 gm. of $NaHCO_3$. If the acid is of proper strength 10 c.c. of it will be needed to neutralize the sodium carbonate. If a less amount is required an additional amount of water is added to bring it to the required strength; this can be calculated by simple proportion. The caustic-soda solution is made by dissolving 40 gm. of the pure caustic in a liter of water. Its exact strength should be determined, and it is always best to make the solutions so that 1 c.c. of the acid will equal 1 c.c. of the alkali. The indicators used are phenolphthalein and methyl orange.

To determine the alkalinity of the solution take an assay ton by weight, or measure out 29 c.c., which will be very close to that amount. If the solution contains cyanide, add silver nitrate in solution until a slight turbidity is produced. Phenolphthalein is then added and standard sulphuric acid is run in to the end point. Each c.c. of the acid consumed is equivalent to 40 oz. troy, or 43.9 oz. avoirdupois, of NaOH to the ton, as the equivalent alkalinity of the solution. Eighty parts of NaOH are equal to 56 parts of CaO.

Alkalinity, or Acidity, of the Ore—Ores are usually acid and seldom alkaline. Take 1 a.t. of the ore, finely ground, and shake it with water for half an hour in a flask; filter and wash with water until all soluble matter is removed from the residue. Test with litmus paper to see if acid or alkaline, and run in enough sulphuric acid or caustic soda, to end reaction. Each c.c. of NaOH used corresponds to 49 oz. troy, or 53.8 oz. avoirdupois of H_2SO_4 per ton of ore. If the solution is alkaline the standard sulphuric acid must be run in to neutral reaction, when each c.c. used will correspond to an alkalinity of 40 oz. troy per ton, expressed in NaOH.

Determination of Cyanide in Solutions—Take 10 c.c. of the solution, or more if weak, in a small flask; add 1 gm. precipi-

*Abstract of a paper by W. H. Seamon, Chihuahua, Mexico, in *West. Chem. and Met.*, August, 1909.

tated lead carbonate and shake thoroughly to remove any sulphides; it is then filtered off and washed, when the solution is ready for titration; 5 c.c. of a solution is then added as an indicator. This indicator solution is made by dissolving 1 gm. of potassium iodide in 1 l. of water. A standard solution of silver nitrate is then run in to the first faint permanent yellow color. Make the silver-nitrate solution by dissolving 6.519 gm. of $AgNO_3$ in 1 l. of water; use 10 c.c. of the solution, each c.c. of which will represent 1 lb. KCN per ton.

Determination of Silver and Gold—Take 1 a.t. or more of the solution in a beaker of sufficient size; place a V-shaped piece of aluminum in the solution and add sulphuric acid to acid reaction, and boil. In a few minutes of hard boiling all of the gold will be precipitated in metallic form, together with the silver. At first some of the silver will be precipitated in form of cyanide, but this changes to metallic silver by prolonged boiling. Remove the aluminum, washing off the precipitated metals with a strong jet of water, filter off the metallic residue, dry quickly and throw the filter into a scorifier with 60 gm. granulated lead; scorify and cupel in the usual way. The precipitation of gold and silver by aluminum is complete, as I have determined by many experiments, and I think its use will be found a great improvement on the methods now employed.

Aluminum was suggested as a precipitant on a commercial scale for gold and silver from cyanide solution as a substitute for zinc by Carl Moldenhauer, who patented his process in 1893. The process failed for the reason that free acid was necessary in the solutions for the complete precipitation of the gold and silver, and as this was not practicable in the commercial extraction it was bound to fail. As a laboratory method it will be found a success.

FIG. 7. LOOKING DOWN UPON THE OVERTURNED CRADLE

Analysis of Commercial Cyanide

Dissolve 20 gm. of the substance in 150 c.c. of water and filter off from any insoluble residue, through an ashless filter, catching the filtrate in a graduated 250-c.c. flask. Wash carefully. The filter is ignited and weighed and the percentage of insoluble matter, which is SiO_2, Al_2O_3, Fe_2O_3, calculated.

Determination of Carbonic Acid—Calcium nitrate is added to the flask and after shaking, the flask is filled up to the mark with water, shaken again and allowed to stand for one hour. It is then filtered, the residue on the filter being $CaCO_3$, proportional to the carbonic acid in the cyanide; it is washed, ignited and weighed as CaO; the weight of CaO mutiplied by 0.786 gives the weight of CO_2 in the 20 gm. of cyanide taken.

Determination of OH—The filtrate from the $CaCO_3$ is diluted to 500 c.c. of which 100 c.c. is taken for the OH determination. To this add a solution of magnesium nitrate and allow to settle for an hour; then filter off the precipitate of magnesium hydroxide, ignite in an annealing cup and weigh as MgO. This weight multiplied by 0.85 gives the weight of hydroxide in 4 gm. of the cyanide, from which calculate the percentage.

Determination of Cyanogen—Take 50 c.c of the 500 c.c. and add 5 c.c. of strong ammonia and 5 c.c. of the potassium iodide indicator; then run in the standard solution of silver nitrate. The CN factor is obtained from the Cl factor by multiplying it by 0.7324 and it will be about 1 c.c. = .0036 CN, when 1 c.c. = 0.005 Cl.

Determination of Cyanate—Take 50 c.c. of the solution and add an excess of a strong solution of silver nitrate which will

precipitate all of the cyanogen, cyanate and chloride combined with the silver; shake well; filter and wash with ice cold water. After washing place a clean flask beneath the funnel and pour over the filter 10 c.c. of standard nitric acid solution, made by mixing 100 c.c. of nitric acid with 900 c.c. of distilled water. The cyanate will act upon the nitric acid. The excess of nitric acid is determined by titration with a standard solution of caustic soda. Each molecule of HNO_3 corresponds to one molecule of CNO. Having determined the number of c.c. of the normal nitric acid that have been consumed by the silver cyanate, as well as the weight of HNO_3 in 1 c.c. of the standard solution, the weight of CNO is found by multiplying c.c. of HNO_3, by weight of HNO_3, multiplied by 0.6666, from which weight the precentage of CNO may be determined.

Determination of the Chlorine—Weigh out 1 gm. of the powdered salt into a small porcelain crucible and heat it, gradually adding a mixture of 5 parts of Na_2CO_3 and 1 part of KNO_3 until all of the cyanogen is decomposed. Cool and dissolve the mass in water, acidify with nitric acid and filter to clear the solution. The chlorine can then be determined by titrating with a standard solution of silver nitrate; or it may be precipitated with silver nitrate and determined in the gravimetric way.

Determination of Potassium and Soda—Decompose in a platinum dish 0.25 gm. of the powdered salt, with dilute hydrochloric acid, being careful to perform the operation under a hood with strong draft to avoid injury from the poisonous fumes; evaporate to dryness and ignite to drive off all salts of ammonia, cool and weigh as $NaCl + KCl$. Then determine the potassium with platinic chloride and the sodium by difference.

Remarks on Cyanide—Pure potassium cyanide contains 40 per cent. of cyanogen and in the trade corresponds to 100 per cent. cyanide. Ninety-eight per cent. cyanide contains only 39.2 per cent cyanogen and 125 per cent. cyanide contains 50 per cent. cyanogen. It has been found that potassium cyanide carrying sodium cyanide is more efficient than the pure article, weight for weight, owing to the larger percentage of cyanogen. This is economy—in the reduction in freights and also for the additional reason that the combined cyanide can be made and sold more cheaply than the pure potassium cyanide.

Camp Bird, Ltd., Buys Santa Gertrudis Mine in Mexico

It is authoritatively announced that the Camp Bird, Ltd., of London, has made a forfeit deposit of 200,000 pesos on the Santa Gertrudis deal at Pachuca, Mexico. The property, officially known as Santa Gertrudis y Guadalupe, has been in negotiation for some months to a syndicate composed of John Hays Hammond, Cortland E. Palmer, Hugh Rose and Frank W. Royer. The option rights of the syndicate were transferred to the Camp Bird, Ltd., after an examination. This company made a rigid investigation under the direction of R. J. Frecheville, engineer of the Camp Bird company, William J. Cox, manager of the Camp Bird mine, Edwin E. Chase, of Denver, and F. J. Pope, of New York. The report of the vending syndicate was confirmed and the Camp Bird company made the deposit, subject to the formal ratification of the option by the Santa Gertrudis stockholders, which is now pending and will be given as a matter of course. The purchase price is 9,000,000 pesos and the option runs until Jan. 1, 1910.

If the purchase is completed a steel and concrete cyanide mill of large capacity will be erected and during the construction of the mill preparations will be made on surface and underground for obtaining an output commensurate with the capabilities of the property.

The Santa Gertrudis is the largest of the three properties (Santa Gertrudis, Barron and La Blanca) on an oreshoot exceeding 3100 ft. in length in the Santa Gertrudis vein.

In the event of purchase being completed it is expected that Hugh Rose, formerly general superintendent of the Guanajuato Development Company, will manage the property.

The above is in confirmation of the official notice in the last report of the Camp Bird, Ltd., which was as follows: "Cable advice has been received from R. J. Frecheville, in Mexico, that a deposit has been made, securing a four months' option on the Santa Gertrudis, a famous mine near Pachuca, Mexico. This option to purchase has been secured on the strong recommendations of Messrs. John Hays Hammond, R. J. Frecheville and W. J. Cox, after making a thorough examination of the mine. As soon as the option agreement and the reports of the above engineers have been received, the board will further communicate with the shareholders."

Dredging Men Win

SPECIAL CORRESPONDENCE

The anti-dredge agitators of the Sacramento valley have met with rather a severe setback in the report of the committee recently appointed by Chairman Marshall Diggs at the anti-dredge convention held in Sacramento to investigate the operations of the dredgers on the American, Sacramento and Feather rivers. The report deals with the dredging conditions on these rivers, which had been condemned severely by the enemies of the gold-dredging industry. The committee finds, after investigation, that in each of the rivers, and at the lands near their mouths, the dredgers are really doing more good than harm, as, instead of sending down débris or sand, the machines are really impounding millions of cubic yards of the sand and keeping it from ever coming down the streams.

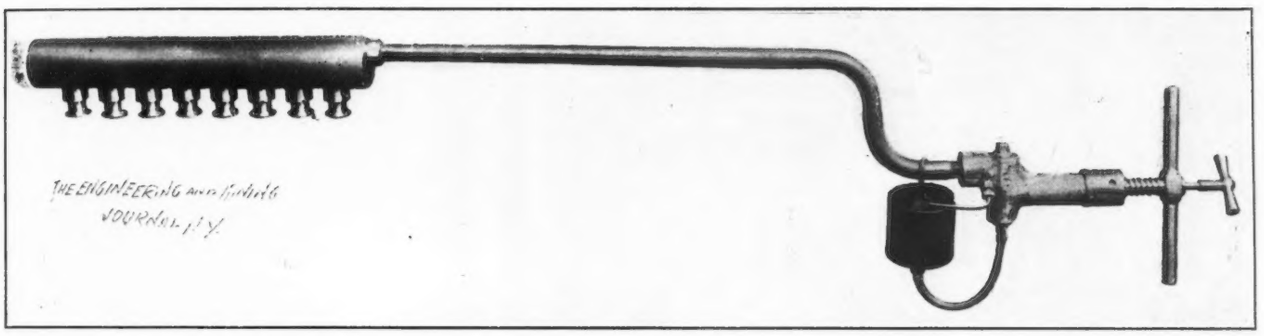
This is a conclusion which was to be expected by those who are familiar with the existing conditions—and who are unprejudiced observers. When the mayor of Sacramento called the anti-dredge convention a few months ago, he did so at the desire of a lot of disgruntled farmers and the Anti-Débris association, who imagined that the damage done by the spring floods was more due to the operations of the dredges than the floods. In fact several dredges were totally wrecked and others badly damaged by these same floods, and the freshet water carried down the rivers and on to adjacent lands much débris in the rivers which had come there by natural erosion and by operations both by farmers and miners in turning over the soil at former periods. These experiences were not at all new ones and had been felt long before dredges were invented or set at work in this State, but opportunity was taken by dredge-mining enemies to make it appear that the dredge-mining industry was ruining lands and doing untold damage to the rivers.

A feature of the convention referred to was that no dredge miners were invited to take part in the discussion, but ex-parte statements were accepted without question and without proof. No mining engineers or other engineers were expected to speak, and what was really an engineering proposition was discussed by men without any knowledge whatever of engineering. The mouse brought forth from the labors of the mountain was in the shape of a committee to confer with the dredge men and with the California Débris commission. The latter declined to interfere, alleging that their duties were confined by law to matters connected with hydraulic mining only, and they had no jurisdiction over dredge mining, a fact which might have been appreciated before they were consulted. On conference with the dredge men themselves, the committee was taken to the dredge fields and shown the actual and practical conditions, and though prejudiced in advance against the industry, they were compelled by what they personally saw, to bring in the report referred to. The dredging industry is a prosperous and growing one, producing much wealth annually and bringing prosperity to the communities where it is carried on. It is, therefore, "fair game" to disgruntled men and those who do not wish to see others prosper. Lands worth nothing even for taxation have been made productive in gold, and extensive industries employing numbers of men have been established.

The Hydraulic Mining Cartridge

The most serious problem confronting coal-mine operators is the prevention of mine explosions. The elimination of all unnecessary dangers underground is the goal toward which modern coal-mining practice is striving. Mining explosives have been much improved in recent years, but they still possess great potential dangers, and accidents are constantly occurring during the firing of shots. More attention is now being paid to the possibilities of mechanical means for getting down the coal. Among several appliances that have been introduced for this purpose is the hydraulic mining cartridge.

The hydraulic cartridge consists of a cylinder of steel made in various sizes and strengths, but usually 20 in. long by 3 in. in diameter, and having eight duplex rams fitted radially along it. By a suitable arrangement of passages a communication is made between each of these rams, whereby simultaneous action can be obtained. By an ingenious contrivance a greater traverse is obtained by these rams than the diameter of the cylinder would appear to allow. This traverse is essential for the complete forcing down of the coal, and the duplex arrangement is a specialty of the present cartridge. Thin liners are used to prevent the rams from cutting into the coal.



THE COMPLETE HYDRAULIC MINING CARTRIDGE. PRESSURE IS ON, AND THE DUPLEX RAMS ARE SHOWN AFTER HAVING COMPLETED THEIR TRAVERSE

The Pump

The cartridge is operated by a new and improved form of pump, now for the first time being put upon the market. Though small, it is extremely powerful, being capable of exerting a pressure of 7 or 8 tons to the square inch. It is of special design and is attached direct to the rigid pipe, with which it is connected to the cartridge. No stand is required so that the appliance can be used either for breaking down or lifting up the coal without special connection, and can be operated in holes drilled at any angle. The pump is fitted with a water tank, about 1½ pints being required for the operation, but most of this returns to the tank and can be used again. A pressure of three tons per square inch is usually required in seams up to 4 ft. thick and this gives a total pressure of 60, 110 and 150 tons respectively on the three sizes of cartridges made.

Preparing the Shot

After the coal has been undercut either by hand or coal-cutter, a hole 3¼ in. in diameter is drilled into the coal slightly less deep than the depth of undercut. This is done by means of an ordinary machine and a special drill. The hole is put in parallel with the roof, and as near as possible along the parting to which the coal ordinarily comes off, or just below it. It is then cleared out. The cartridge with one or more liners, and having the pipe and pump attached, is pushed to the back of the hole. The water tank is filled and hung on the pipe, the rubber suction pipe coupled and the taps turned. The coal sprags are all left in tight.

The small handle is first actuated slowly until pressure is reached, when the screw handle is turned. The pressure being fully on the power of the apparatus is soon apparent, for the coal is heard to be rumbling and cracking. This is allowed to continue until the back portion of the coal is broken off, after which the sprags are slightly slackened. By a continuance of the pumping, the pressure is brought to bear at the front of the face, and continues to spread until the operation is completed. The sprags are then withdrawn. The whole process occupies about ten minutes. The machine can be used either for longwall or room-and-pillar work; also for lifting-up the coal or bringing down roof.

Every coal seam has its particular characteristics, and only by actual tests can it be discovered just what size of cartridge and what mode of application will be best adapted for the work at hand. Experience will teach as to whether the nature of coal requires a rapid application of pressure, or whether a slower application will be more effective. Actual use also, will show whether it is wise or not to continue the application of pressure while the coal is working on its own account. A careful manipulation of the sprags will always result in a greater quantity of coal being forced down.

The amount of coal brought down per thrust varies with the thickness of seam and the depth of the undercut. Usually on a longwall face, holes are placed 6 ft. apart, and if the seam is 3 ft. thick and the depth of undercut is from 4 to 5 ft., three tons per thrust would be brought down. The usual number of thrusts averages about 25 per day, giving a total tonnage of about 75 tons per machine per day. In several English mines each machine averages about 90 tons per day.

Cost of Repairs

At one European colliery where 10 machines were used and four standby cartridges were kept ready, 38,263 thrusts were performed in 12 months. The books of this company show that the total cartridge cost of renewals and repairs, aside from capital outlay amounted to $625. This cost was equal to 0.28c. per ton of coal obtained by the cartridge.

The texture of the coal and the character of the roof and floor parting have much to do with the satisfactory use of the machine. If the coal has a strong tendency to adhere to the floor or roof the cartridge would not be likely to force the coal away. The presence of balls of iron pyrites or other foreign substances in the coal seam would not interfere with the efficient operation of the cartridge, but would affect the drilling of the holes. A hard seam is more preferable than a soft one, especially if the roof is strong and good. If the mine is developed with narrow rooms and the coal is strong and more than 5 ft. thick, a large size of machine is necessary.

Aside from the question of safety in the operation of mines, the use of the cartridge where conditions are favorable is accompanied by a considerable saving. The saving that results from the elimination of all powder charges is partly offset by the small additional cost incurred in drilling a larger hole than is necessary, when explosives are used. The real and important saving resulting from the use of the cartridge comes from the higher

percentage and better quality of the lump coal produced.

In European mines where the cartridge has been introduced, the percentage of round coal has increased from 10 to 20 per cent. At one mine, where 15 machines are employed, the saving per machine was $14.75 per day. This saving resulted from the production of 11 per cent, more round coal than was previously produced with explosives. The Hydraulic Mining Cartridge Company has examples of this machine at 42 Broadway, New York.

Illinois Coal Production in 1909

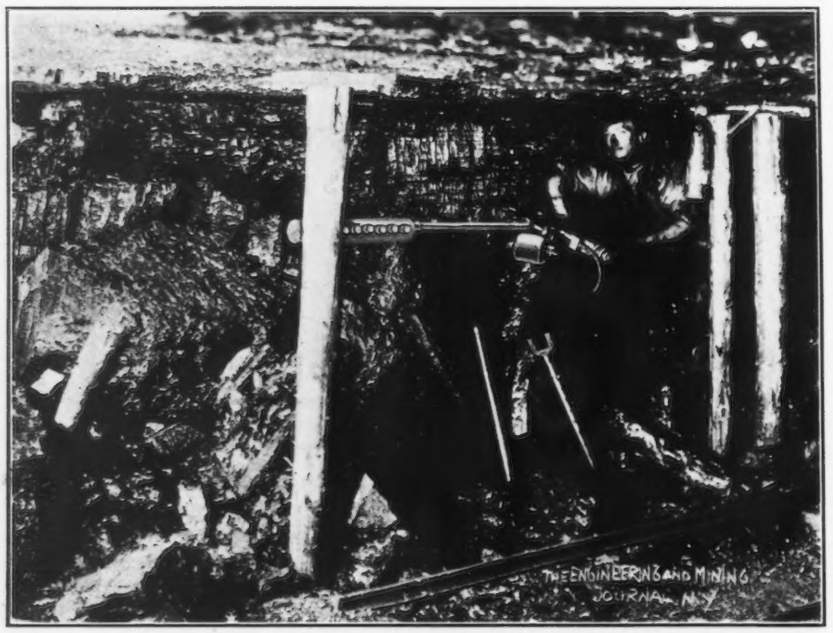
David Ross, secretary of the State Bureau of Labor, has received from the 10 district mine inspectors of Illinois, reports of the production of coal for the year ended June 30, 1909. The total output for the year was 48,625,885 tons, a decrease of 646,567 tons or 1.3 per cent. compared with the tonnage of 1908. From a production standpoint the recent business depression throughout the country did not affect this industry in Illinois as seriously as many supposed it had. Allowing for the increase of normal years, the loss in tonnage is comparatively slight.

The 8th district, comprising the coal counties of St. Clair and Madison, reports a loss of 1,311,388 tons; the 6th (the central district) 152,132 tons; the 5th, (the eastern district) 789,255 tons, while the 2d and 3d districts in the northern field show losses of 85,000 and 90,000 tons respectively.

These losses were almost balanced by an increase of 79,585 tons in the 1st district; 71,060 tons in the 4th district; 355,618 in the 7th; 836,647 in the 9th and 439,063 in the 10th. With the exception of the 8th district, the most notable increases are in the counties lying south of Springfield, each producing from 6,500,000 to nearly 9,000,000 tons.

Fatal Accidents

The number of fatalities was 213 compared with 183 in 1908, an increase of 16.4 per cent., making the highest rate ever reached in this respect during any one year's operations. This regrettable increase comes from the 9th district reporting 78 fatal accidents as against 33 last year. Franklin county, made notorious by the Leiter explosions at Zeigler, is in this district and the repeated explosions at this mine being attended with heavy loss of life, were responsible for the increased casualties this year.



GENERAL VIEW AT FACE AFTER COAL HAS BEEN BROUGHT DOWN AND THE HYDRAULIC CARTRIDGE IS BEING WITHDRAWN

Colliery Notes

Cement was recently used in connection with the foundation of a set of coke ovens, and notwithstanding the high temperature, it remained as hard as flint.

Common mortar should never be used in damp situations, as it absorbs moisture freely, and does not harden, but remains rotten, and in course of time drops from the walls.

Investigation at a European colliery showed that where an electrical hoisting plant was installed, there resulted a saving of 22 per cent. in the steam consumption, as compared with the steam winding plant that was formerly used.

Cement and lime should not be mixed together, as the rate of setting in the two ingredients is not equal in point of time, and the molecules of the stronger, pull the weaker ones asunder, both being affected to their disadvantage.

Hydraulic lime mortar is reported to have been used by Vitruvius about the year 80 B.C., but we have no evidence to show how far it was successful in setting under water, nor have we any evidence that he understood the chemistry of lime. The properties of lime for setting under water remained unknown until the middle of the eighteenth century, when Smeator first gave an impetus to its use.

At all American coal mines, where a suitable and sufficient electric supply exists, and where there is provision to prevent entire stoppage in case of failure in the power supply, hoisting by electricity is worthy the most careful consideration of all mine managers. At one German mine where electrical hoisting is in use, 3200 tons of coal are raised per day of 16 hours winding, with an average of 40 hoists per hour.

Longwall mining machines are now working in Scottish coal mines on an inclination of 27 deg., cutting uphill and downhill 130 yd. per shift regularly. At one of the mines on the Continent, a mining machine is operating in a bed inclined 38 deg. European mine managers claim that coal-cutting machines can be used on inclinations steeper than 38 deg. In America, mining machines are seldom used on even a 10 per cent. inclination.

In planning a system of underground haulage, it is impossible to fix any definite gradient upon which the haulage will self-act, or run back by gravity; this question depends largely upon the condition of the road and the size and manner in which the rails are laid. The style and size of the car wheel is also an influencing factor. When the cars are heavy and the wheels large, a trip of cars will run back on a gradient of less than 1 in 36. Such a light grade, however, is rather exceptional and it may be generally considered, where average conditions exist, that a gradient exceeding 2 or 3 in. to the yard is about correct to apply in a main-rope haulage system.

The practice of mixing mortar varies considerably, but engineers who have studied the action of the hydrates know that rich limes require to be exposed to the air before being used, so as to enable them to take up the carbonic-acid gas present in the air and water, and in order that they may get rid of the unslaked particles and gain strength. When thoroughly cooled, both lime and cement lose the power to swell and lift masonry; but the exposure may be too long, in which case it weakens the material. Cement swells in consequence of too much silica being mixed with the alumina to form the compound; the trouble then rests with the burner, and not with the engineer or the architect.

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Mining to Keep the Mill Running

Our London correspondent in an article on Rand costs in this issue calls attention to an abuse that has crept into the methods of that district, this being the crushing of easily obtainable but unpayable rock in order to increase tonnage and inversely reduce the working cost per ton. This is a consequence of the recent mania to attain the minimum level of operating expense, which, of course, is highly praiseworthy *per se*, but rank nonsense if achieved at the expense of profit. This may seem paradoxical but it is not so. It has been shown repeatedly in discussions in the JOURNAL, and it is well known to mining engineers, that a reduction in the cost of mining is not necessarily commendable; and that an increase in the cost may be attended by a greater ratio of increase in the profit. This follows from the principle that the purpose of mining is to get ore, not barren rock.

The fallacy that is now engaging attention on the Rand is by no means confined to that district. There is more than one mine in the United States where the managerial mind is concentrated upon improving the record of cost per ton mined that would pay larger dividends if the same thought were directed to increasing the grade of the ore hoisted. The quarrying of rock can be done very cheaply, but the company that is mining for copper, lead, zinc, etc., is not doing so for the amusement of seeing the wheels of the mill go around.

If a large percentage of waste has to be supplied by an over-milled property to keep the mill going at full capacity it would obviously be cheaper to dig it by steam shovel from some convenient ledge than to obtain it from underground at a cost of $1@2 per ton. However, this expedient would appear like a *reductio ad absurdum* even to a low-cost maniac. One of the oldest, most successful and most reputable of the Lake Superior copper-mining companies abandoned a few years ago its practice of reporting the cost of mining per ton of ore. This was done because the publication of the figures inspired rivalry among the captains of the several mines of the company, each anxious to show the minimum cost, but the management figured that the leaders in that particular did not make the cheapest copper and that it was preferable to concentrate attention upon the latter point.

In the mining of most orebodies—even in the mining of coal—there are lean or barren streaks that must be taken in order to get the ore on either side. It sometimes happens that the outer streak of an orebody is rich and the inclosing rock must be cut into adequately to insure getting all of that rich streak. It is a common occurrence that in stoping a streak of ore at least twice its width of barren rock must be broken in order to make an opening large enough for the miners to work efficiently. But with allowances for such conditions, which, of course, constitute a large part of the art of good mining, it may be laid down as a principle that the less worthless rock be broken the better it will be for the balance sheet. The primitive miners generally had this principle well in mind, and so have the tributers of our own time.

The Journal as an Information Bureau

We received recently the following letter from an appreciative correspondent at Bisbee, Arizona:

"I beg to acknowledge your letter of the 5th inst., communicating to me most courteously and fully the information requested, and at the same time returning my check for $5 to pay for the same. I suggest that the JOURNAL establish an information bureau for the benefit of persons like myself who want immediate answers to inquiries for information, for which they would gladly pay a modest sum. I think that many of us, like myself, feel a delicacy about obtaining the benefit of the labor of someone else without giving something in return."

So appreciative a letter is naturally gratifying to us. We do not see our way clear, however, to inaugurate an information bureau of any different scope from that which we are conducting. We fear that our readers do not always realize the scope of the JOURNAL. The JOURNAL is itself the biggest and broadest information bureau that exists in the mining industry, and the reader who goes carefully over its weekly presentation of news, technical and commercial, and general information will not need to ask many special questions.

Our guiding principle is to tell our readers of the things about which they need to know. If any of our readers asks a ques-

tion that gives us the idea that here is something about which we ought to tell, but have previously neglected to do so, we feel like sending that correspondent a check instead of accepting one from him (except, of course, for his subscription), and are glad to spend as much in investigating the subject as in our opinion the subject is worth.

We receive many inquiries that are of interest only to him who makes them, and are neither of such importance nor originality as to lead to investigation with a view to bringing out something of general interest, or even to be worth while answering through the columns of the paper. We are always glad to reply immediately to such inquiries by mail or telegraph when we are able to do so readily, or even if we have to take a little trouble, such as looking up some reference, making an inquiry by telephone, etc. This is a part of the mutuality that we conceive to exist between us and our subscribers. (We hope that all of these inquiries are from subscribers.) We do not want to start any coupon system, or ask anything extra for such friendly assistance, and do not intend to do so. We hope that our friends and subscribers will continue to ask us questions just as they always have been doing.

However, there are some inquiries at which we draw the line. First, there is the unreasonable inquiry from the man who wants too much. Not long ago we received a letter that in effect was as follows: "I see that you are willing to reply to questions in the JOURNAL. Will you please answer the subjoined:" Then followed four closely typewritten pages of questions of a highly special and professional character. We estimated that if an editorial assistant were detailed to this special matter, he might, with proper guidance from a superior, be able to answer these questions after about two months of investigation and study. Consequently, we had to ask this correspondent to excuse us. We object also to answering questions that should properly be addressed to an engineer in his professional capacity. We are annoyed to be asked to look up matters that our correspondents could just as easily do for themselves. We feel vexed to be asked to answer some question inspired by a certain article, when the question was answered in the article itself, as would have appeared if the inquirer had read the whole article. Finally, we are apt to lose our patience when we are asked to reply to the same inquiry that has previously been answered repeatedly in the columns of the paper.

But to the reader who is neither unreasonable, nor lazy, nor careless, to whom we can be helpful, we say that we are glad to lend a hand, and there need be no hesitation about asking us or accepting such assistance as we can give. If there be any feeling of delicacy, it certainly need not be entertained by anyone who is a subscriber to the paper.

The Lehigh Coal and Navigation Company

The ownership of anthracite coal lands has become so centralized and generally fixed that any important changes seem unlikely. The remaining independent companies, with one exception, are not only comparatively small in their operations, but are so widely scattered that any attempt to consolidate them would be exceedingly difficult. The only large block of anthracite coal remaining in the hands of a single company outside of the large transportation lines is that of the Lehigh Coal and Navigation Company in the Lehigh region. This company has been highly prosperous and has expended a large sum in drainage and other improvements which will enable it to increase its shipments whenever that may seem desirable.

Some three years ago holders of a majority of the stock in this company placed their stock in trust, with a view to selling the control should it seem advantageous. The stock at that time was bid for by several parties, but all the negotiations fell through, although the pool was continued and still exists. Recently the stocks of this company have been very active indeed in Philadelphia, and large blocks have been bought in, including stock represented by the pool or trust certificates. Naturally this movement has caused a good deal of comment and various rumors have been current regarding the buyers, though none of them seem to be based on really reliable information. The favorite report is that the control in the company is wanted by the New York, New Haven & Hartford Railroad Company, which was one of the bidders for the property three years ago, and which already controls the New York, Ontario & Western railroad and its mines.

Whether this report is true is a matter of considerable doubt. The Ontario & Western road is closely connected with the New Haven's Poughkeepsie Bridge line, by which its coal can be directly delivered throughout western New England. To make the connection with the Lehigh Navigation lines some 30 or 35 miles of railroad would have to be built, which, however, would not be a very difficult undertaking. The Lehigh Coal and Navigation Company, moreover, is to some extent hampered by a contract to deliver a large part of the coal which it produces to the New Jersey Central railroad which leases its Lehigh & Susquehanna line. It is doubtful whether the Jersey Central would be willing to give up this contract, which brings it a large tonnage yearly, much of which it would lose in case the coal went directly to New England.

It is altogether possible that the New Haven company is not the purchaser in the present case, and the control of the Lehigh company may be sought for speculative purposes entirely. Beyond question it is a valuable investment, even at the present high prices which are more than double the par value of the stock.

It is to be hoped that the President will adhere to his announced determination to see that the appointments of supervisors for the coming census shall be made without reference to political considerations. The taking of the census on the lines now laid down is a serious business matter, and requires considerable knowledge and some business ability on the part of those in charge. The statistics collected may be of great value to business men and manufacturers, if the work is properly done, and the information is arranged and given out by persons having some familiarity with statistics. If this intention is carried out, the figures collected and presented will be of very much greater value than those of some former censuses.

If the cyanide process be found generally applicable to the extraction of the silver of the Cobalt ore it will be a great boon to that district. We understand that some experimental work in this direction has been promising.

Views, Suggestions and Experiences of Readers

Comments on Questions Arising in Technical Practice and Debatable Points Suggested by Articles in the Journal

CORRESPONDENCE AND DISCUSSION

The Clinton Iron Ore in the Chattanooga Region

The following correspondence is self-explanatory. We need add only that upon receipt from Mr. Jones of copy of the letter that he addressed to Doctor Smith of the U. S. Geological Survey, we asked the latter for his side of the controversy, so that both might be presented at the same time. We have excised from the letters of both Mr. Jones and Mr. Burchard some personal matters that were not pertinent to the main subject.

The Director, U. S. Geological Survey, Washington, D. C.

Dear Sir: I have recently read Bulletin 380-E, and especially the article therein entitled, "Clinton Iron Ore in Chattanooga Region," by E. F. Burchard. Mr. Burchard's work is usually of such a character that myself and a few others to whom I have spoken, and who are acquainted with the principal deposits of Clinton iron ore in Chattanooga region, are amazed at the statements which he makes.

In that part of the article under the caption "Pigeon Mountain" he says for instance, "The three beds of ore occur just below the middle of the Clinton (Rockwood) formation. They are about 25 ft. apart but only the lowest bed, which is 2½ ft. thick, can be considered of much importance." This statement is wholly incorrect, and Mr. Burchard was shown exposures that amply proved to him that the middle seam is as well developed in the north end of Pigeon mountain and as thick as the lower seam; that each of them will average 3½ ft. of iron ore, exclusive of the partings contained in the seam. For sufficient proof of this, I refer you to "Fossil Iron Ores of Georgia," by Professor McCallie, State geologist for Georgia, and published in the latter part of 1906. Major Singleton, who was connected with the Georgia Iron and Steel Company for many years, reports over his signature during the past six months, 14 ft. of marketable ore in four seams of ore in the very place where Mr. Burchard says there are 2 7/10 ft. of ore parted by five or six seams of shale. I, personally, have been upon this property six or seven times, and I indorse fully the statement above as referred to, by Professor McCallie and Major Singleton.

Another statement made by Mr. Burchard is, "The iron content ranges from 25 to 32 per cent." This statement of his was supposed to include the ore at Estelle, as well as the ore west of Copeland station on the Central of Georgia Railway. This is also grossly incorrect, the proof being furnished by the furnace records of the Chattanooga Iron and Coal Company, the furnace of which is located here, and which used all the ore produced at Estelle. The average of the hard ore used in this furnace and mined at Estelle is 37 per cent. metallic iron, three years average.

I have a letter before me from the furnace chemist in which he says, "In reply to your recent letter, I would say he certainly is mistaken in regard to the analyses of the Estelle hard ore. I notice that the Roane Iron Company was given as authority of some analyses of Estelle ore. All I know is, I didn't give any such analyses. I know Mr. Burchard personally, and feel sure he was misinformed as to the analyses of this ore." He then gives me the analyses of the ore, and continues; "I am sure it never ran as low as 32, much less 28 per cent. as Mr. Burchard gives it in his pamphlet."

* * * * * *

Mr. Burchard indirectly, and the U. S. Geological Survey directly, is the cause of a great wrong being done to the Chattanooga district. The ore in the Chattanooga district is vastly better than is therein stated, and if Mr. Burchard had deliberately endeavored to do all in his power to injure the Chattanooga district with reference to the quantity and the quality of the Clinton iron ores found therein, he could not have done more than has been done by the Bulletin of which he is author.

E. M. JONES.

Chattanooga, Tenn., Aug. 11, 1909.

Mr. E. M. Jones, President, Cogar Creek Coal Company, Chattanooga, Tenn.

Dear Sir: The reply to your letter of August 11 has been delayed on account of both Mr. Burchard and myself being in the field. I take pleasure in forwarding herewith a copy of Mr. Burchard's reply. I am also sending a copy of his reply to the editor of the ENGINEERING AND MINING JOURNAL, who requested it on account of receiving a copy of your letter containing the criticism of Mr. Burchard's report.

Before receiving Mr. Burchard's reply I felt confident that he had not departed from the practice of the Survey geologists in examining and reporting on mining properties and districts. I believe that you will see that your criticisms are based upon misinterpretation of Mr. Burchard's paper.

I should perhaps explain that the change in the title of the report by the chief geologist was in accord with a practice that I have urged of omitting the word "preliminary" from titles of reports except where more detailed work is already planned for. While I share Mr. Burchard's realization of the need of further work in the Chattanooga district, I would not feel justified in promising such work by the use of the word "preliminary."

Yours very respectfully,
GEO. OTIS SMITH,
Director.

Washington, Sept. 3, 1909.

Dr. George Otis Smith, Director U. S. Geological Survey, Washington, D. C.

Dear Sir: The letter of E. M. Jones, of Chattanooga, Tenn., with reference to estimates of Clinton iron ore in the Chattanooga district published by the survey in Bulletin 380-E, is received. Report on the same has been delayed until I could procure a copy of this paper.

Taking up Mr. Jones' criticisms in order, I find that he has mininterpreted the first statement that he quotes, viz., "Three beds of ore occur just below the middle of the Clinton (Rockwood) formation. They are about 25 ft. apart, but only the lowest bed, which is 2½ ft. thick can be considered of much importance." As is shown by the text immediately preceding and following, this statement refers particularly to the Estelle locality. The middle bed may be the thickest west of Copeland, and there is nothing in the text to indicate that it is not. In fact the average thickness given in the text, namely 2 7/10 ft., would indicate that this is the case. I have not my notes on that area with me, but it is my impression that it was the middle bed which appeared most promising near Copeland. This very fact lends weight to the probability that the iron-ore beds vary considerably from place to place, so that it would be unsafe to consider that the beds all continue uniformly from Estelle to the point west of Copeland. As to the measurement of the thickness of the main bed west of Copeland, I could not after careful study of my field notes, by any stretch of the imagination, make the workable ore in each of the two beds average 3½ ft. thick as Mr. Jones states was proved to me. The estimate of 2 7/10 ft. may be conservative, and Mr. Jones is referred to the statement on page 4 of the paper to the effect that it is believed that the figures given are in the main conservative. No

exposures were shown to me that proved anything more than I have published. The field work was done in 1906, and there may have been development work done since then that has shown up more ore. I sincerely hope so.

With reference to the iron content averaging from 25 to 32 per cent. in the hard ore, and the analyses quoted, this was the best information I could get on the subject. In 1906 I made three visits to the office and furnace of the Chattanooga Iron and Coal Company, in Chattanooga, and asked for analyses of the ore from Estelle and vicinity. At first I was refused any analyses, and later was put off with promises, so I left with the manager addressed franked envelops and blanks to be filled out. No records were ever furnished me, however. In the autumn of 1908 when I was in Chattanooga, this furnace was shut down. Finally I secured the records as given, from the Roane Iron Company, and published them rather than leave a blank space for this locality. It is entirely possible that these may not be representative of the best ore in this locality, but if so it would appear to be the fault of the former Chattanooga Iron and Coal Company. In this connection it must be considered that the ore heretofore used from Estelle has been largely of the soft, or semi-hard variety, and doubtless such ores may have averaged 37 per cent. iron. It is significant that with the approaching exhaustion of these soft and semi-hard ores operations at the Estelle mines were temporarily discontinued.

* * * * * *

In general Mr. Jones assumes that this report has done a great wrong to the Chattanooga district. Doubtless it may disappoint the hopes of some who are accustomed to use extravagantly exaggerated figures in the hope of selling unprofitable holdings, or of attracting capital to a locality. For my part I think it makes the Chattanooga district compare very favorably with other districts of the South. The reserves of ore that will be available for future use are shown to be larger than those of the Birmingham district, judged by the same standards. Central location, water powers, railroads, and nearer markets all combine to favor Chattanooga, and the immediately available Clinton ore resources that have been shown by the reports are sufficient to last nearly 100 years, even though the present rate of production be increased.

Since publishing this paper I have expected just such criticisms from a number of sources, and have received several already. I suppose it is a penalty one has to pay for having nerve enough to attempt the delicate work of making estimates. Nevertheless I am probably the strongest friend the Chattanooga district has on the Survey. I have twice submitted estimates for additional geological work in that area, and urged that more detailed work be done before publishing any estimates. The manuscript of the present report was entitled "A Preliminary Estimate of Tonnage, etc." When it had been revised by the chief geologist the title stood "Tonnage Estimates, etc." I still urge that further work be done in the Chattanooga district, so that the studies may be based on the same detail as those recently concluded in the Birmingham district. I have heard some suggestions of coöperation on the part of Chattanoogans, and if this could be adopted perhaps the interested parties would be more willing to abide by final results.

Very respectfully,
E. F. BURCHARD.
Assistant Geologist.

Beloit, Wis., Aug. 30, 1909.

The Director, U. S. Geological Survey, Washington, D. C.

Dear Sir:

* * * * * *

It is an error to leave out the word preliminary to any such examination as this one was. It explains something that needed explanation. . . I admit Mr. Burchard's first point in his letter, a copy of which you have inclosed to me; but, as to his other answers I wish to, if I may, offer some further information.

On the property west of Copeland referred to, Professor McCallie, who made his investigations about the time Mr. Burchard was on the property, in "Fossil Iron Ores of Georgia" printed in 1908, pp. 101 to 106, shows the upper of the two lowest beds to have an average ore content exclusive of partings of 42⅔ in.; the lower bed, 44⅔ inches.

In the same volume, pp. 99 to 100, you will find analyses of the Estelle hard and soft ores respectively as follows: Hard ores, metallic iron, 32.18, 37.85, 38.42; insoluble, 13, 12, 18; soft ores, metallic iron, 54.42, 53.83 per cent.

You will notice that I do not give myself as sole authority for any of the statements given, but only corroborate them; therefore, Mr. Burchard does not reflect on me in his statement, "Doubtless it may disappoint the hopes of some who are accustomed to use extravagantly exaggerated figures in the hope of selling unprofitable holdings . . . ." Professor McCallie is very competent and others who corroborate him have standing in their profession.

With reference to Mr. Burchard's statement about the iron content, in which he says he failed to get the analyses from the Chattanooga furnace and says that he got them from the Roane Iron Company: The chemist of the Roane Iron Company wrote me under date of August 2: "and also noticed that the Roane Iron Company was given as authority for some analyses of Estelle ore. All I know is I didn't give out such analyses." Since Mr. Burchard failed to get any sort of information that could be relied upon about the iron content of the ore, he had no right to publish what he did. In my letter to you I stated: "The average of the hard ore used in this furnace (the Chattanooga furnace) and mined at Estelle is 37 per cent. metallic iron, three years average." Therefore, Mr. Burchard's remark "In this connection it must be considered that the ore heretofore used from Estelle has been largely of the soft, or semi-hard variety, and doubtless such ores may have averaged 37 per cent." is uncalled for. It is wrong to try to convey the impression that most of the ore mined at Estelle was of the soft variety, and of low iron content. They mined a great deal more hard than soft ore. The average analyses of the soft ore mined at Estelle and used in the Chattanooga furnaces was, metallic iron 49.45 per cent. and insoluble, 19.85. He is further in error when he states that the operation at Estelle was discontinued because of the "approaching exhaustion of these soft and semi-hard ores." He ought to know that the operations were discontinued because of the Southern Steel Company going into bankruptcy.

It is all well enough to say the report is "conservative," but it may be so conservative as to be damaging, and this point needs to be guarded against, especially by the U. S. Government.

I shall take up the matter of coöperation with you with the Chamber of Commerce, and, if I am successful, we shall try to get Mr. Burchard to return and go over the district with the desired care, but we hope that it will not take four years to print the results of that work, should it be done.

Yours truly,
E. M. JONES.

Chattanooga, Tenn., Sept. 7, 1909.

Speed of Pelton Wheels

In an article on "Speed of Pelton Wheels," appearing in the JOURNAL of Sept. 11, this appears: "To get the maximum efficiency from a Pelton wheel it should travel a third as fast as the water striking it."

Now in looking up this subject in my notebooks I find that by mathematical demonstration the speed of this type of wheel should be one-half the speed of the water. Reference to Bowies' "Practical Treatise on Hydraulic Mining," page 196, shows the same problem worked out with identical results.

Is the above quoted statement not erroneous? If not, I should like very much to be set right by a mathematical demonstration of the position inasmuch as this is an important point in water-wheel design.

New York, Sept. 13, 1909. ENGINEER.

[The quoted statement is incorrect. "Engineer" is right.—EDITOR.]

The Carn Brea & Tincroft mines, Cornwall, during the past half year (MIN. JOURN., Aug. 21, 1909) stamped 21.2 tons of rock per ton of coal consumed.

Details of Practical Mining

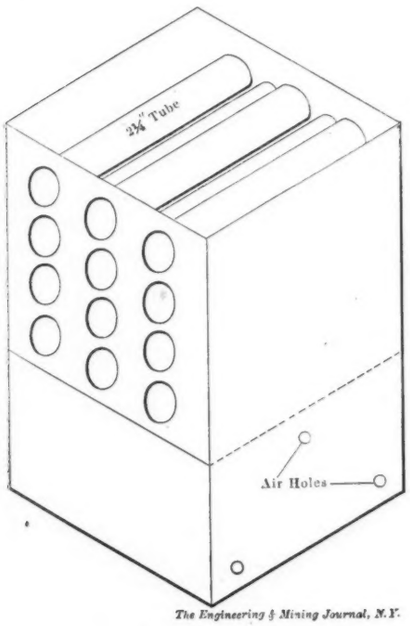
Notes of Interest to the Operators of Small Mines as Well as of Large Mines. The Things That Have to Be Done in Everyday Mining

REPORTS FROM EXPERIENCE

Readers of the JOURNAL are invited to contribute to this department. Articles should be brief, thoroughly practical, and preferably illustrated by drawings or sketches. Our draftsmen will prepare properly any kind of a pencil sketch that is intelligible. Something that is an old story in one district may be quite unknown in another. Articles accepted and published are suitably paid for.

Thawing Dynamite

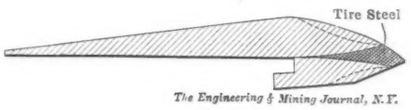
The accompanying sketch shows a type of thawer used by the Oliver Mining Company, Hibbing, Mich., which has given excellent satisfaction. It is made of galvanized iron, about 10x10x16 in. high. Twelve 2¼-in. tubes are soldered in, giving the appearance of a tubular boiler. Six inches from the bottom is a water-tight partition, above which is water to cover the tubes. The ends of the tubes are open for the insertion of the sticks of dynamite. Two or three short pieces of candles placed below furnish heat for warming the water, unless hot water is available to start with. A metal cover is placed over the box. The candles are thoroughly inclosed beneath and obtain an ample supply of air through three ventilation holes on each side.



POWDER THAWER

Steam Shovel Teeth

A new use for old locomotive-tire steel has been found in the Mesabi district, Minnesota. The wear and tear on shovel teeth is excessive, and many different kinds of steel have been experimented with in the hope of finding the most durable, and at the same time a steel that is not excessive in cost. The ordinary steel dulls easily in the heavy work required of the shovel, and it has been found that the best and most serviceable point is one made of old locomotive-tire steel. This steel is designed for rough usage and is both hard and tough. The tooth is made in three pieces, two of which are forged from ordinary steel billets. The tire steel is inserted between the other two, thus making a hard center. The outer steel being soft wears faster, and in this way leaves a thin cutting edge. Should the top or bottom become worn too much, it is then faced with tire steel, as indicated by the dotted lines in the accompanying sketch. On account of the different composition of the two steels, it is necessary to heat them in separate forges, as the tire steel does not seem to require as high a temperature for welding purposes as does the ordinary steel. A high-grade steel costs from 6 to 8c. per lb., while tire scrap may be purchased for $15 per ton. About 20 lb. of tire steel are used for each tooth, which means a saving of $1 to $1.25 per tooth. In addition to this it wears better and longer, and in this way gives an additional saving, as well as better satisfaction.

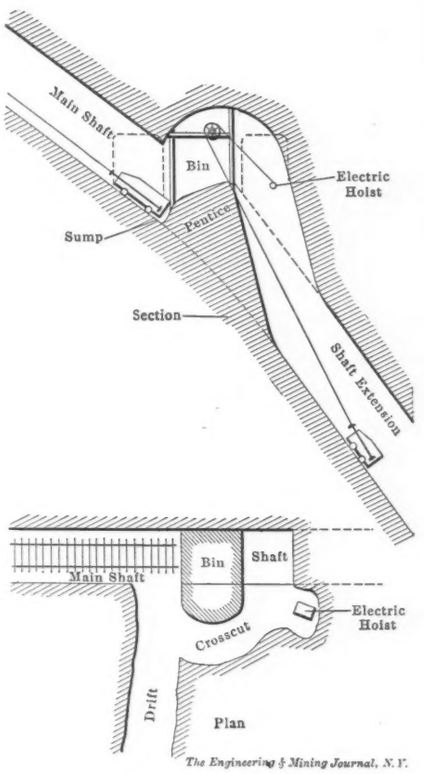


SECTION OF STEAM SHOVEL TOOTH

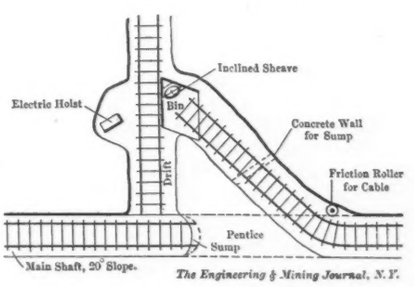
Shaft Sinking at Stella Mine, New York

The accompanying illustrations show the methods of shaft sinking as used by the St. Lawrence Pyrites Company, DeKalb Junction, N. Y. In each case it was desired to sink the shaft and at the same time continue hoisting ore. As there were no levels below the shaft sump, there was no opportunity for extending the shaft by means of a raise from lower levels. The Stella shaft is inclined at an angle of 18 deg.; the Anna at 45 degrees.

At the Anna shaft advantage was taken of an existing crosscut, and a stope in an upper branch to start the new section of the shaft, back of and above the sump.



DETAILS OF ANNA SHAFT EXTENSION



PLAN OF STELLA SHAFT

The hanging-wall was taken out sufficiently to allow the construction of a small ore bin, as shown in an accompanying drawing, and at the same time provide space for the sheave. An electric hoist was installed in the crosscut a little to one side of the shaft. The ore bin is constructed just above the

incline shaft so that the ore can be dumped directly into the skip and taken to the surface. A small self-dumping skip is used in the shaft extension and all the material from the shaft is dumped into the ore bin.

The method employed at the Stella shaft is to drift out about 20 or 25 ft. from one side of the main shaft and then sink on the incline at such an angle as to meet the line of the permanent shaft at a distance of 30 to 35 ft. below the working level. One reason for not cutting out the hanging-wall, as was done at the Anna, was that the roof was barren. In the Stella, all of the work was done in the main orebody. When the line of the main shaft was reached, this auxiliary shaft was then deflected so as to be a continuation of the desired shaft. The ore from the auxiliary shaft is dumped into the bin and transferred by car to the main shaft.

Another advantage of sinking the shafts by these methods is that the sump was maintained in perfect condition and the pumps were able to take care of all of the water so that the work below was comparatively dry. The auxiliary shaft at the Stella is to be walled in with concrete at its junction with the main shaft and will then be used as a sump to catch all of the water from the upper levels.

Driving Inclined Raises with Stoping Drills

By Arthur O. Christensen*

In driving raises to connect levels for ventilation, or to prospect veins or the country above tunnels, it is customary to drive as small a raise as is possible to work in, to drive it perpendicular, and to timber it with pairs of stulls 3½ or 4 ft. apart. In the case of such work I have found two styles of raise easier, cheaper and safer to drive than the type mentioned.

The first is a type of inclined raise which is described below. The second is a type of vertical raise which will be described in a later issue.

The Inclined Raise

The inclined raise may be run at any desired angle in the vein, or may cut through the country rock. The advantages of it are that it requires no timber; it advances horizontally as well as perpendicularly; for short distances it prospects ground more cheaply, and is more rapidly driven than a drift or vertical raise. No mucking is required and a "buzzer" (hammer stoping drill) can be used. By making the raise incline about 40 deg. the muck runs down into the chute at the bottom of itself. Occasionally it is necessary to scrape down some of the dirt which packs on the bottom.

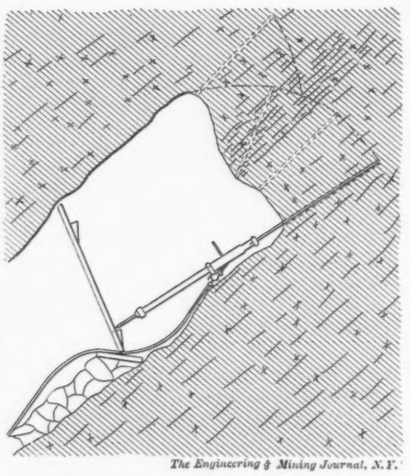
*Mining engineer, Dorchester P. O., Colo.

For raises steeper than 40 deg. it is well to put a light stull or piece of lagging across the bottom of the raise every 4 or 5 ft., and not over a foot above the bottom. Dirt fills in behind these and they form steps making it easier to climb up, and aiding in rigging up a brace for the machine at the breast. These steps also serve to catch steel and tools which are accidentally dropped by the miner.

Setting up the Machine

The materials required to make a set-up are a few pieces of plank of varying lengths, wedges and spikes. With these it is always possible to brace the machine for any hole, although frequently moiling has to be done to get a suitable hitch for the plank on the roof. The accompanying illustration gives an idea of the raise, how to rig up a plank to brace the machine against, and a satisfactory round of holes.

By frequent use of the scraper, or by using hollow steel, flat or even down



MACHINE SET UP IN INCLINED RAISE

holes can be driven, although such holes are seldom needed in driving a raise.

Rate and Method of Advancing

To clean the face, set up at the breast and be ready to drill, need not take over an hour, and if the tools do not have to be carried far it is often possible to get started in half that time. To put in the round of about 8 holes, averaging 3 ft. deep, takes about 1½ or 2 hours. In good ground with no mishaps 3-ft. holes with a small sized Waugh require, on the average, only 10 min. each. The largest size drills, using larger steel, drive 4-ft. holes in the same time. If a nipper brings the powder to the miner it is possible for him to shoot twice, thus making 4 ft. a shift. Otherwise 2½ ft. is as much as can be expected for a daily average.

After advancing 30 or 40 ft. it is well to cut a station or pocket in the side of the raise in which to keep the machine tools, etc. To cut this pocket usually requires two rounds. Sometimes pockets are run 10 or 20 ft. in the form of inclined drifts from the raise with the purpose of prospecting the walls. Such drifts serve as very convenient stations in which to store planks, etc.

It is often well to timber the pocket to protect the tools kept in it, and to keep them from rolling out or getting buried. Where it is not attempted to shoot twice a shift all this is easily done after the regular round is put in. During two consecutive days rounds are shot out of the side, and on the third day the pocket thus formed is timbered. The timbering required is simple, and takes a man only a couple of hours to place.

By putting in a pocket every 30 or 40 ft. an inclined raise of this character can be carried up as far as 200 ft., although to climb up such a distance becomes difficult, and it requires time to keep the dirt from piling up on the bottom and filling the raise.

The vertical distance made by such a raise is only 60 or 70 per cent. of the total distance covered, yet, by being able to shoot two rounds in the breast each shift, except on those days when cutting or timbering a pocket, it is possible to get up faster than with a vertical raise. Then, too, ground is being prospected horizontally to the extent of 70 or 80 per cent. of the length of the raise. For these reasons, for prospecting a vein above a tunnel for short distances, this form of raise seems cheapest and most speedy.

Wrinkles for Ventilating Mine Workings

The schemes for aiding the ventilation of a tunnel or shaft in out-of-the-way places are, to say the least, interesting, and often effective. In a shaft the prospector often builds a fire at one end on the bottom. This is especially efficient in a two-compartment shaft when the timbers are close down. A little sheet-iron stove with a long chimney to the surface is an "improvement" over the open fire. Sails are sometimes rigged to deflect the wind down a sheet-iron pipe to the shaft bottom.

Ventilation at tunnel faces is helped by a simple sheet-iron pipe fitted with an elbow at the portal and having a vertical length of pipe set in the elbow. A small stove may be inserted at the elbow, which draws air from the drive and uses the vertical pipe as a smoke stack. Small wooden fans are fitted with footpower attachments like that used on grindstones.

Drunkenness in the underground employees of a mine is best detected when the men leave the dry or change house, preparatory to going into the mine. The high temperature of the change house is a severe test on a man who is carrying a "load" and trying to hide it.

Patents Relating To Mining and Metallurgy

A Selected and Classified List of New Inventions Described during the Past Month in the Publications of the Patent Offices

UNITED STATES AND BRITISH PATENTS

A copy of the specifications of any of these patents issued by the United States Patent Office will be mailed by THE ENGINEERING AND MINING JOURNAL upon the receipt of 25 cents. British patents are supplied at 40 cents. In ordering specifications, correspondents are requested to give the number, name of inventor and date of issue.

ALUMINUM

SOLDER for Aluminum. Zoltan Tamassy, Cleveland, Ohio, assignor of one-third to Zoltan B. Csiky and one-third to Etel Ots, Cleveland, Ohio. (U. S. No. 931,523; Aug. 17, 1909.)

SOLDERING—Process for Soldering Aluminum. Fritz Stalder, Ernst S. Scholl and Gottfried Dubach, Pieterlen by Biel, Switzerland. (Brit. No. 23,779 of 1908.)

COAL AND COKE

COAL CUTTING—Improvements in and Relating to Coal-Cutting Machines. A. Anderson and Anderson Boyes & Co., Ltd., Motherwell, Scotland. (Brit. No. 23,140 of 1908.)

COAL-HANDLING APPARATUS. George W. Freeland, Moline, Ill., assignor to Williams, White & Company, a Corporation of Illinois. (U. S. No. 928,595; July 20, 1909.)

COKE—Apparatus for Conveying Coke from Coke-Ovens. Erskine Ramsay, Birmingham, Ala. (U. S. No. 933,666; Sept. 7, 1909.)

COKE-LOADER. Charles H. Wright and Will K. Monroe, Cleveland, Ohio, assignors to the Brown Hoisting Machinery Company, Cleveland, Ohio. (U. S. No. 931,110; August 17, 1909.)

COKE OVENS—Improvements in or Relating to Horizontal Regenerative Coke Ovens. Harold W. Seymour, Leeds, England. (Brit. No. 21,249 of 1908.)

GASES—Apparatus for Removing Gases and Foul Air from Mines. Joseph C. Stirling, Bakerstown, Penn. (U. S. 932,916; August 31, 1909.)

PEAT-WORKING MACHINE. George Matthews, Riga, Mich. (U. S. No. 932,041; Aug. 24, 1909.)

COPPER

LEACHING—Process of Leaching Copper Ores. Georg C. Schneider, Freiberg, Germany, assignor to Eugen Abresch, Neustadt a. d. Haardt, Germany. (U. S. No. 932,643; Aug. 31, 1909.)

PYRITIC SMELTING FURNACE. Story B. Ladd, Washington, D. C. (U. S. No. 931,775; Aug. 24, 1909.)

GOLD AND SILVER

FILTER. Edwin Burt, El Oro, Mexico. (U. S. No. 931,267; Aug. 17, 1909.)

PLACER MINING—Portable Placer-Mining Apparatus. James M. Low, Los Angeles, Cal. (U. S. No. 932,037; Aug. 24, 1909.)

IRON AND STEEL

BLAST-FURNACE DUST—Manufacture of Agglomerated Bodies from Blast-Furnace Dust. Wilhelm Schumacher, Osnabrück, Germany. (U. S. No. 933,269; Sept. 7, 1909.)

BLAST-FURNACE DUST—Manufacture of Coherent Bodies from Blast-Furnace Dust. Wilhelm Schumacher, Osnabrück, Germany. (U. S. No. 933,270; Sept. 7, 1909.)

COATING WITH COPPER—Improvements in or Relating to the Coating of Iron or Steel with Copper, Copper Alloys, or Other Metal, such as Silver or Gold, which will Readily Alloy with Copper. William G. Clark. Geelong, Victoria, Australia. (Brit. No. 16,820 of 1908.)

CORROSION—Improvements in or Relating to the Treatment of Iron or Steel for Preventing Oxidation or Rusting. Coslett Anti-Rust Syndicate, Ltd., and Thomas W. Coslett, Birmingham, Eng. (Brit. No. 15,628 of 1908.)

PIPING IN INGOTS—Apparatus for Reducing Pipes in Ingots. George L. Norris, Burnham, Penn., assignor to the Standard Steel Works, Burnham, Penn., a Corporation of Pennsylvania. (U. S. No. 931,792; Aug. 24, 1909.)

REFINING—Method of Refining Iron. Paul Sejournet, Paris, France, assignor to Société Electro Metallurgique Francaise, Froges, France. (U. S. No. 928,551; July 20, 1909.)

TREATMENT OF STEEL—Process for the Treatment of Steels for Industrial Purposes. Eugène Schneider, Le Creusot, France. (U. S. No. 931,499; Aug. 17, 1909.)

LEAD

RED LEAD—Improvements in and Apparatus for the Manufacture of Red Lead (Oxide of Lead). George V. Barton, Old Quay, Runcorn. (Brit. No. 13,458 of 1908.)

MAGNESIUM

ELECTROLYTIC PRODUCTION of Magnesium. George O. Seward and Franz von Kügelgen, Holcombs Rock, Va., assignors to Virginia Laboratory Company, New York, N. Y., a Corporation of New York. (U. S. No. 931,092; Aug. 17, 1909.)

PETROLEUM

WELL-DRILLING APPARATUS. Henry B. Walker, Mount Vernon, Ohio, assignor to Oil Well Supply Company, Pittsburg, Penn., a Corporation of Pennsylvania. (U. S. No. 931,101; Aug. 17, 1909.)

TIN

DETINNING—Improvements in or Relating to Apparatus for Extracting Tin from Tin Plate Waste. Dr. Heinrich, Kempen-on-Rhine, Germany. (Brit. No. 16,895 of 1908.)

ZINC

ORE TREATMENT—Process of Treating Zinc-Lead Ores. Frederick T. Snyder, Oak Park, Ill., assignor, by mesne assignments, to Electric Metals Company, Chicago, Ill., a Corporation of West Virginia. (U. S. No. 933,133; Sept. 7, 1909.)

SULPHIDE OF ZINC—An Improved Process of Manufacturing Sulphide of Zinc. J. C. A. Meyer, Lyons, France. (Brit. No. 25,965 of 1908.)

MINING—GENERAL

MINE-DOOR. Charles W. Carman, Mount Hope, W. Va., assignor of one-half to William E. Deegans, Glen Jean, W. Va. (U. S. No. 931,035; Aug. 17, 1909.)

SHAFT SINKING—Improved Method of Shaft Sinking and Lining by Ferro-Concrete Tubing. Robert Johnson, John W. Johnson and George Johnson, Newbiggin-by-the-Sea, Northumberland. (Brit. No. 18,412 of 1908.)

WITHDRAWING MINE PROPS. R. Higginbotham and O. Murphy, Rotherham, Yorkshire, Eng. (Brit. No. 6539 of 1908.)

ORE DRESSING—GENERAL

CENTRIFUGAL SCREEN. William R. Cunningham, Bucyrus, Ohio, assignors to the American Clay Machinery Co., Bucyrus, Ohio, a Corporation. (U. S. No. 931,280; Aug. 17, 1909.)

CHILEAN MILL. William B. Easton, Chicago, Ill. (U. S. No. 931,186; Aug. 17, 1909.)

MAGNETIC SEPARATION—Improvements in the Magnetic Separation of Ores and Other Materials and Apparatus Therefor. George Ullrich, Aizenau, Germany. (Brit. No. 14,082 of 1908.)

MAGNETIC SEPARATION—Process of Treating Ores by Magnetic Separation. Alfred A. Lockwood and Marcus R. A. Samuel, London, England. (U. S. No. 933,717; Sept. 7, 1909.)

ORE-CONCENTRATOR BELT. Thaddeus R. Brooks and George E. Bateman, San Francisco, Cal. (U. S. No. 931,991; Aug. 24, 1909.)

ORE GRANULATOR or Pulverizer. John G. Kirksey, Quincy, Ill. (U. S. No. 931,316; Aug. 17, 1909.)

RECIPROCATING MECHANISM—An Improved Reciprocating Mechanism for Trough Conveyers, Screen Gold Washers and Other Apparatus Requiring such a Motion. The Hardy Patent Pick Company, Ltd., Heeley; and George Smith, Sheffield, Eng. (Brit. No. 16,195 of 1908.)

SCREENS—Improvements in or Relating to Screens Employed for Screening, Grading Crushed or Broken Stone, or Ore or Like Material. Wm. H. Baxter, Leeds, Eng. (Brit. No. 10,824 of 1909.)

SEPARATION PROCESS—Process of Separating Suspended Matter from Liquids Containing Mineral Value. Prosper J. A. Maignen, Philadelphia, Penn. (U. S. No. 932,795; Aug. 31, 1909.)

SEPARATOR—Dry-Ore-Separating Machine. William W. Bonson and Willson L. McLaughlin, Dubuque, Iowa, assignors to Highspeed Dry Concentrating Company, Phœnix, Ariz., a Corporation of Arizona. (U. S. No. 933,053; Sept. 7, 1909.)

STAMP MILLING—Improvements in Apparatus for Removing Dies, Heads and the Like from Stamp Batteries for Crushing or Milling Ores. Frederick Thomas, London, Eng. (Brit. No. 3251 of 1909.)

METALLURGY—GENERAL

METALLURGIC PROCESS to Produce Metals or Steels of all Qualities. Louis H. Baraduc-Muller, Paris, France. (U. S. No. 933,357; Sept. 7, 1909.)

ORE REDUCTION—Method of Reducing Ores. George F. Rendall, New York, N. Y., assignor to American Reduction Company, a Corporation of New Jersey. (U. S. No. 932,175; Aug. 24, 1909.)

PURIFYING GASES—Process of Purifying Gases Containing Sulphur Dioxide. Herman Hegeler, Danville, and Nicholas L. Heinz, La Salle, Ill. (U. S. No. 931,868; Aug. 24, 1909.)

SMELTER SMOKE—Method of Treating Corrosive Gaseous Fumes or Smoke. Clarence B. Sprague, Salt Lake City, Utah, assignor to United States Smelting, Refining and Mining Company, a Corporation of Maine. (U. S. No. 931,515; Aug. 17, 1909.)

MINING MACHINERY AND APPARATUS

DRILLING-MACHINE. Charles B. Richards, Cleveland, Ohio, assignor, by mesne assignments, to the Cleveland Rock Drill Company, Cleveland, Ohio, a Corporation of Ohio. (U. S. No. 932,060; Aug. 24, 1909.)

HOISTING—Improved Means for Arresting Accidental Descent of Mine Cage Lifts and the Like. D. S. Fleetwood, C. W. Flack and Seth Lax, Barnsley, Eng. (Brit. No. 20,287 of 1908.)

PROP for Mines. Freidrich Nellen, Essen-on-the-Ruhr, Germany. (U. S. No. 931,466; Aug. 17, 1909.)

PUMPING—Improvements Relating to the Raising of Liquids from Bore-Holes by Means of Air-Lift Apparatus. C. Isher & Co., Ltd., and Frederick Broadhurst, London, Eng. (Brit. No. 27,159 of 1908.)

METALLURGICAL MACHINERY AND APPARATUS

FURNACE FOR VOLATILE METALS. Woldemar Hommel, London, England, assignor to Metals Extraction Corporation, Ltd., London, England. (U. S. No. 932,279; Aug. 24, 1909.)

ORE-REDUCING FURNACE. George F. Rendall, New York, N. Y., assignor to American Reduction Company, a Corporation of New Jersey. (U. S. No. 931,145; Aug. 17, 1909.)

RABBLE ARM. Charles H. Repath, Salt Lake City, Utah, assignor to Frank Klepetko, New York, N. Y. (U. S. No. 932,496; Aug. 31, 1909.)

SLAG—Apparatus for Handling Slag. David T. Croxton, Cleveland, Ohio. (U. S. No. 932,765; Aug. 31, 1909.)

Personal

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

H. C. Hoover, of London, arrived in New York on Sept. 21.

George Beebe has returned to New York from Sonora, Mexico.

J. Parke Channing is expected home about the end of September.

Oscar Adams Turner has opened an office at 42 Broadway, New York.

B. B. Thayer, president of the Anaconda Mining Company, is in Butte, Montana.

J. R. Finlay has returned from a professional journey of six weeks in the West.

Charles F. Rand, president of the Spanish-American Iron Company, has sailed for Europe.

W. A. Thomas, president of the Thomas Steel Company, Niles, Ohio, has returned from Europe.

Juan F. Brandes, of Denver, Colo., has gone to Mexico City and Parral, Mexico, on professional business.

J. J. Culley, manager of the Accord Mining and Milling Company at Georgetown, Colo., is making a business trip to eastern points.

Robert Hawxhurst, Jr., has resigned the management of the Poderosa Mining Company, Ltd., of Chile, and is returning to London.

W. E. Corey, president of the United States Steel Corporation, who has been confined to his home as the result of an accident, has fully recovered.

B. W. Traylor, vice-president of the Traylor Engineering Company, is now making a trip through Arizona and Mexico in the interests of his company.

Leonard Peckitt, president of the Empire Steel and Iron Company, Catasauqua, Penn., has returned from a visit to his native place, Thirsk, in Yorkshire, England.

H. A. Shipman, of London, formerly mining engineer in South Africa and Australia, has been looking at mining property in the Clear Creek district in Colorado.

C. H. Macnutt has succeeded Robert Hawxhurst, Jr., as general manager of the Poderosa Mining Company, at Mina Poderosa (Collahuasi), Antofagasta, Chile.

Manley B. Baker has been appointed head of the Department of Geology of the Kingston, Ont., School of Mining, to succeed R. W. Brock, now director of the Geological Survey of Canada.

F. S. Lewis, of Philadelphia, vice-president, and J. N. N. Shainer and S. B. Marshall, directors, of the Dominion Bessemer Ore Company, Ltd., recently visited the mine near Port Arthur, Ontario.

H. A. Hillman, erecting engineer for the Traylor Engineering Company, recently left Allentown for Cobalt, Ont., where he will superintend the construction of a concentrating mill for the Silver Cliff Mining Company.

Franz Schmacks, manager of the Aktien Gesellschaft fuer Kohlendestillation Gelsenkirchen, of Duesseldorf, and Dr. J. A. Roelofsen, manager of the Coal Distillation Company, of Middlesbrough, England, have arrived in this country. They represent the Huessener & Collin by-product coke ovens.

Thomas B. Dennen has resigned as mine inspector for the Pocahontas Consolidated Collieries Company, to accept a position with the Big Vein Pocahontas Coal Company at West Pocahontas, Va. Mr. Dennen had his early training in the anthracite coal region, but has been in West Virginia for 19 years, for seven years past with the Pocahontas company. He has been specially successful in rescue work at the Lick Branch and other accidents.

President Taft has appointed the new Tariff Commission, which is to assist him in the execution of the tariff law. The board consists of three members, as follows: Prof. Henry C. Emery, of Yale University, chairman; James B. Reynolds, of Massachusetts, now assistant secretary of the treasury, and Alvin H. Sanders, of Chicago. With the announcement of the selection of this new board, authorized by the Payne tariff bill, this statement was given out: "The President and the Secretary of the Treasury have agreed upon the plan that these three gentlemen are to constitute the board and are to be given authority to employ such special experts as may be needed in the investigation of the foreign and domestic tariff." Professor Emery has always been regarded as a radical tariff reformer. He succeeded Arthur T. Hadley as professor of political economy when Doctor Hadley was made president of Yale University. He has written considerably on economics. Mr. Sanders is a supporter of reciprocity.

Obituary

A. V. Temple, industrial commissioner of the National Railways of Mexico, died at Mexico City, Sept. 10. He was long identified prominently with Mexican mining.

W. B. White died at Salt Lake City, Utah, Sept. 7, aged 65 years. For nearly 40 years past he had been engaged in mining in Nevada and Utah, and was interested in many enterprises. Recently he had been engaged in the development of the Clear Creek country in Utah.

Harold Heathcote Harvey, mining engineer, died at his home in Oakland, Cal., Aug. 24. He was 32 years old, and was a graduate of the University of California in the class of 1900. He was a member of the American Institute of Mining Engineers. Much of his professional work was in Alaska, where he contracted typhoid fever in 1906, which later developed into tuberculosis. He leaves a widow, formerly Miss Edith Goodfellow, of Oakland.

James Henry Covode died recently at La Paz, Bolivia, aged 45 years. He was born in Pennsylvania and graduated from the Rensselaer Polytechnic Institute at Troy, N. Y. He was employed as a civil engineer on the survey of the Nicaragua canal route in 1884-86, and later on the Pennsylvania railroad. In 1897 he settled in San Francisco and devoted himself to mining engineering. At the time of his death he was exploring mining prospects in Bolivia for a New York syndicate.

J. J. Hagerman, for many years a prominent business man of Milwaukee, president and manager of the former Milwaukee Iron Company, now the Illinois Steel Company, principal stockholder of the Mollie Gibson mine in Colorado, and a railroad and irrigation promoter and builder, is dead at Milan, Italy, where he, with Mrs. Hagerman, was seeking to renew his health. Mr. Hagerman, who was 72 years of age, became ill in 1882 and went to Colorado Springs. While there he became largely interested in the development of the Mollie Gibson mine at Aspen, which later became famous as a dividend payer. Later he became extensively interested in mining enterprises at Cripple Creek. While living in Colorado Mr. Hagerman built the Colorado Midland Railroad, a narrow-gage line in the mountains. In 1895 he built the Texas Valley Railroad and financed and built the canal of the Pecos Irrigation Company. One of his sons is Gov. Herbert Hagerman of New Mexico.

Societies and Technical Schools

Scranton Mining Institute—The first meeting of this society at Scranton, Penn., for the season will be held Oct. 19. It is expected that Dr. Holmes, of the United States Geological Survey, will give an illustrated lecture at this meeting. The institute has now about 400 members on the roll.

American Peat Society—The third annual meeting was held in Boston, Sept. 23-25 Papers were presented by practical peat men describing the peat plants in operation, and the various experiments made in all parts of this country and Europe. Arrangements for the meeting were in charge of a local committee, of which Wilbur F. Goodrich was secretary.

Special Correspondence from Mining Centers

News of the Industry Reported by Special Representatives at San Francisco, Butte, Denver, Indianapolis, Salt Lake City, Goldfield and London

REVIEWS OF IMPORTANT EVENTS

San Francisco

Sept. 17—The hearing of the petition of the Selby Smelting and Lead Company for a new trial has again been put over until the latter end of the month when the lawyers will submit their affidavits and arguments. The attorneys representing the company claim that the noxious fumes which are complained of by the farmers and the citizens of Benicia come from the oil refinery on the shore of San Pablo bay, an upper arm of San Francisco bay. Affidavits to prove this contention have been submitted to the court and will later be considered.

Suit has been filed in the Federal court at Los Angeles which involves title to several millions of acres of oil lands in Coalinga, Midway and other oil fields of the central valley, now held under patent by the Southern Pacific Railroad Company. Patents were granted for this land many years ago. The validity of the government patents is attacked in the suit, the contention being that the land was granted as more valuable for agriculture than mining and that since the granting of the patents only mining has been carried on upon the land, none of it being fit for agricultural purposes. These facts have been well understood for many years but this is the first time that such a suit has been instituted, though the California Miner's Association endeavored long since to have the lands examined by the government and the mineral lands segregated, but the influence of the railroad company in Congress was too strong and they continued to get their patents without official interference. This was unjust, of course, but the railroad plan was carried out and the Miner's association was defeated in trying to have restored to the public domain the well-known mineral lands within the railroad grants.

The once famous mining camp of Brandy City, in Sierra county, which in years gone by produced large quantities of gold and was then virtually deserted for years is again becoming a comparatively lively place. Geo. W. Taylor has about 75 men opening some old gravel claims there and preparations are being made for work on a large scale. The town is again to have a post office and a telephone line is being brought in from Camptonville. The revival of the mining industry in the quartz mining sections of Sierra county has brought this change about.

The engineers of the Turlock and the Modesto irrigation districts have reported to the two irrigation boards certain details about finding reservoir sites in the Tuolumne meadows and Poopenaut valley. Then the engineers and officials of the La Grange Mining Company and the Tuolumne Mining Company made a proposition to the boards that the mining and irrigation companies unite in a search for suitable reservoir sites. The idea of an irrigation board joining with a mining company for any purpose was displeasing to some of the farmers present but it was finally decided to extend the reservoir sites into a little valley close by, on which the mining companies have an option and which had not before been considered by the irrigation engineers. The engineers from both boards and the engineers of the mining companies as well, have been instructed to look over the new district and report conclusions. This seems to be one instance at least of the farmers and miners "getting together."

The Cherokee mine, Butte county, is to be opened from the west end of the channel at Flag cañon, from which point over a mile of the channel may be worked. The mine was ground-sluiced in early years until 1872, when English capital was enlisted and hydraulic mining was conducted on a large scale until the anti-débris decisions closed it, since which time work has been conducted upon a small scale only. During its palmy days the mine yielded at one clean-up $70,000, which was cast in one gold bar and exhibited in this city. Subsequently the mine was drifted but for some reason this system was given up.

The Omega drift gravel mine on Oregon creek, Alleghany, Sierra county, has run into gravel in its channel which is yielding about $60 per cubic yard and the good people of Forest and Alleghany are excited over the prospects. The gravel is not cemented and is being crushed in a mill of 100 tons daily capacity. The rich gravel is being taken out 1000 ft. from the mouth of the tunnel and close to bedrock. This is encouraging news for the Slattery or New Jersey mine as well as the Corotoman, Young America, Lucky Dog and Maple Groove drift mines and the Rio Antiqua in particular. These mines are supposed to be on the same channel. The Omega is owned by a company of San Francisco and San Jose people of which J. L. Green is manager.

There is to be a '49 "gold excitement" at Stockton in November in commemoration of the sixtieth anniversary of the "rush" to the mines of Amador, Calaveras and Tuolumne counties in the early days. At that time most of the miners from San Francisco passed through Stockton, having come there by way of the San Joaquin river in sailing vessels, boats, etc., whence the stage lines took them to the new diggings. It is proposed to enlist the aid of other counties to make this a good celebration and committies have been named to confer with the commercial bodies of other cities and towns. Stockton is again, after many years, a base of supplies for certain mining counties. It seems as if there was still some sentiment remaining in California connected with the early days of mining in the State but it has been dormant many years. Possibly the proposed celebration at Stockton may revive interest in these matters.

About three years ago the Bagdad-Chase Mining Company, operating mines in San Bernardino county, Cal., and also in Idaho, purchased the old Soulsby mine at Soulsbyville, Tuolumne county, the mine being one which had yielded some $5,000,000 or $6,000,000 above the 400 level before the ledge was "lost." The faulting of the vein in the '80s stopped production, but the company hopes to find the vein again, and spent three years' time and several hundred thousand dollars in the search and has now found it quite a distance west of the old workings in a territory passed by as barren by the company's predecessors. Superintendent Charles L. Pierce set men crosscutting in virgin ground and the ledge was found. It is of high grade, and there is plenty of it. A notable feature of this strike is that the company had about decided to quit operations and close the mine down, but Superintendent Pierce insisted on driving a north crosscut from the 400 level of the central shaft at his own expense. After going only 20 ft. the miners struck the Soulsby vein in virgin ground clear to the surface. In addition to free gold the ore is heavily shot with galena carrying high values.

Butte

Sept. 16—The trouble between Newman Erb and F. A. Heinze over the management of the Davis-Daly Company has led to the resignation of the former from the board of directors, of which he was chairman. The trouble between the interests represented by the two is of long standing. Mr. Erb has been willing to let Mr. Heinze dictate the policy of the actual mining operations, but has insisted that Heinze keep out of the financial and bus-

iness end of the concern—a thing Heinze has been quite unwilling to do. Mr. Erb states that of the $1,200,000 paid into the treasury by the stockholders there remains but $200,000, and that he wished a change made in the control of the company at the annual meeting of stockholders to be held Sept. 28. For the purpose of voting the stock at the annual meeting Mr. Heinze and Mr. Erb were originally appointed a proxy committee. To this committee was later added Mr. Raborg, and immediately thereafter Mr. Erb tendered his resignation. This has necessitated the destroying of the original proxies and new ones are to be sent out at once. It is supposed that by this action of Mr. Erb, Mr. Heinze is left in control of the coming meeting and will completely dominate the actions of the stockholders.

The Copper Eagle Mining and Smelting Company has issued a call for a special meeting of stockholders Sept. 20 to vote on the giving of a lease on a portion of the company's property to the Mines Leasing and Developing Company.

Goldfield

Sept. 16—It is more than likely that the next meeting of the board of directors of the Goldfield Consolidated company will take under advisement the matter of enlarging the Consolidated mill in certain portions, increasing its capacity from 600 to 1000 tons per day. It will also be suggested that the old Combination mill, now treating about 90 tons per day, be abandoned and dismantled. Recent developments in the mine have opened such vast quantities of ore running less than the grade now maintained at the mine that it is deemed advisable from an economic standpoint to make the above changes. It is well known that the Combination mill is expensive to operate. It was built prior to the railroad and is not so substantially built or as well arranged as the new mill. Laboring under these disadvantages the cost of milling is nearly $4 per ton, while the Consolidated mill treats ore for less than $2 per ton. It is estimated the additional capacity of the mill can be made at an expense of not more than $100,000, as the present crushing, concentrating table, and cyanide tank capacity is sufficient to handle the product from an additional 50 stamps.

The sessions of the American Mining Congress will be held in the Hippodrome theater and the headquarters will be at the Goldfield hotel. The railroads have given reduced rates from all points and the indications are the congress will be well attended. Wednesday, Sept. 29, will be spent at Tonopah and a special train has been arranged to transport the delegates to that point, via Millers station, thus enabling them to view the mill of the Tonopah Mining Company. When the congress is not in session a committee will provide entertainment for the members, and after adjournment an opportunity will be given to inspect the mines and mills of the district.

Denver

Sept. 17—Asbestos mining in the vicinity of Casper, Wyoming, on the line of the Chicago & Northwestern, is beginning to take actual and active shape, and it is asserted the district will be a competitor of the famed mines of Quebec, from which the United States derives its main supply. By a coincidence, the first and chief developers of this industry were sheepmen, who now combine the production of wool from the backs of that doubly useful animal, with that of the mineral wool which they dig from between the ribs of serpentine which inclose it, dikes of which rock are found in the Casper range skirting the North Platte valley. Henry C. Beeler, late geologist of Wyoming, has reported fully on these deposits, and advised the exploiting of the ground and erecting of mills, which is now being energetically done. The Wyoming Consolidated Asbestos Company, James H. Bury, manager, and the North American Asbestos Company, C. C. P. Webel, president, are the chief operators in the district. J. C. Ross, of Elyria, Ohio, has the contract for the building of the two mills.

The new tariff bill recently passed by Congress seems to have met with the full approval of the miners of zinc in the Joplin district, for the Zinc Ore Tariff club of the Missouri-Kansas region has announced that having accomplished the good work for which it was organized, it now ceases to exist, and closes the club with thanks to the people of the United States who have coöperated with it in its efforts. Valuable deposits of zinc are reported discovered about 10 miles east of Plateau, El Paso county, Texas. The vein is said to be wide and rich, and as it is at shallow depth, and has no water to contend with, it can be mined most economically. The discoverer, H. Clogenson, of Dallas, is manager of a company which he has organized to operate the property.

The local daily press is asking the reason why the Japan-Flora mines, in the Telluride district of the San Juan region, are so long idle, when "there is exposed, sampled and measured up 100,000 tons, having an average value of $14 per ton, exclusive of its zinc contents, which can be worked at a profit of $5 to $6 per ton." The reason, perhaps, is that it is a silver-lead and zinc-blende ore, and the silver is not in the galena and gray copper—as in the case in most of the San Juan mines—but in the zinc-blende, and the zinc and galena cannot be separated, and the zinc is penalized. This is a problem for the metallurgists, but it does seem a pity that $500,000 profit should be locked up there.

With the rapid improvement in the mining industry and the resulting increase of "suckers" who get the speculative fever, the "wild-catters" are getting very busy. Wyoming is just now a favorite stamping ground for these predatory animals, and it is stated that one man in Sundance has defrauded Eastern people of $30,000 through worthless mineral locations. Another big steal, perpetrated by a Philadelphia man, was by means of 300 fraudulent oil claims, the methods and the man being exposed by the former State geologist, Henry C. Beeler.

Cobalt

Sept. 18—In view of the persistent rumors that the government will reduce ore royalties levied on the mines, it is of interest to note what properties will be benefited. Those paying royalties to the Ontario government are: Chambers Ferland, 15; O'Brien, 25; Crown Reserve, 10; Temiskaming and Hudson Bay, 15 per cent. In addition to these properties all the lots in the Gillies Limit will have to pay royalty of 10 per cent. There are, however, also a number of companies that have to pay royalty to the Temiskaming & Northern Ontario Railway commission. These are Right of Way, Townsite, Nancy Helen, City of Cobalt, Station Grounds, Jackpot, Wright and Railway Reserve, all paying 25 per cent. It is, of course, not necessary that the Railway commission reduce its royalties if the government does, as these are entirely independent as far as the mining rights are concerned.

The report of the engineer and auditors of the Peterson Lake Mining Company in the dispute with the Nova Scotia has culminated in an action by the former company for the recovery of one million dollars from the Nova Scotia. The report of the engineer claims the Nova Scotia trespassed on the Peterson Lake property, and has removed a large quantity of ore. The report also claims there has been carelessness in the handling of the ore, and that the Peterson Lake interests were not properly looked after. It is also stated that no return was made to the Peterson regarding one car of ore shipped from its property, and that improper deductions have been made. These charges are denied by the Nova Scotia.

Another dispute has come up between the Coniagas mines and the town of Cobalt, which threatens to end in a law suit. The Coinagas have a number of lots adjoining the property on Prospect avenue which they bought from the owners, and these are assessed as town lots. The mine appealed to the Court of Revision to have them assessed as mining property, but the latter upheld the commissioner, and now the company has decided to appeal to the courts to have the property assessed as mining lands at $10 per acre.

The further development on the veins recently found on the Nipissing hill is giving very satisfactory results. Vein No. 122 has been traced for over 800 ft. on the surface, and underground development has shown it to be in places about 15 in. wide.

Within the last week an automobile service has been started between the town of Cobalt and the Kerr Lake district. A large tally-ho has been secured and is now running five trips a day as far out as the Temiskaming.

Good progress is being made with the Nipissing Central Railway, the electric line which is to connect the towns of New Liskeard, Haileybury and Cobalt. The grading between Haileybury and Cobalt is nearly completed, and the rails are now coming in. The company hopes to have the rails laid some time in November.

Toronto

Sept. 17—The Ontario Government has sold by tender the Provincial mine on the Gillies timber limit south of the Cobalt area, comprising about 30 acres, to F. M. Connell, of Haileybury, for $113,111, reversing a royalty of 10 per cent. on the output. Fifteen other properties on the limit with an aggregate area of 319 acres, were also disposed of, the prices per lot varying from $2250 to $20,600. The total receipts from the sales, including the Provincial mine were $223,054—a 10-per cent. royalty being reserved in each case. The bids were considerably higher than when the properties were previously offered, owing to the important discovery at the Waldman mine.

I. Watters, formerly of Ottawa who was engaged by the Bacalieu syndicate, which comprises Montreal and American capitalists, to explore for minerals in Newfoundland has returned to Montreal and reports having located a number of valuable claims. These include iron-ore deposits on Little Belle island, near those of the Dominion Iron and Steel Company and Nova Scotia Steel Company; oil shale on the northeast coast and lead on the west coast. Preliminary tests of the latter have shown a good quality of lead and several tons of the ore will be brought to Montreal for further experiments. Should these result satisfactorily development will be commenced forthwith.

Mexico

Sept. 16—The flood situation in the Monterey district appears to be much more serious than the first reports indicated. The loss in life is appalling, and the property loss will reach many millions. The greater part of the property loss falls upon the railroad companies and upon individuals, but undoubtedly a number of the mining companies have suffered greater or less losses directly or indirectly. Smelter No. 2 and the steel plant at Monterey were materially damaged by the flood. Most of the mines in northern Mexico are situated above the flood plains in the isolated sierras, and consequently would not be directly damaged by the flood. However, in many cases the transportation systems for these mines have been completely wiped out, and the mines all have suffered a large loss from the incidental derangement of the railroad transportation system of the whole section. On the other hand, the abundant rains of northern Mexico this season will insure better crops for next year, and probably will forestall any suffering during the dry season similar to that which was experienced last year. The rains have been general and heavy all over northern Mexico, and aside from the direct damage from excessive floods this is an advantage for the mining industry of that section.

Notwithstanding the tariff on zinc ore, the August shipments to the United States were nearly up to the average. The railroads report 152 cars of zinc ore passing through Laredo and El Paso during that month. Many of these shipments were on contract, or to clean up stocks on hand at the mines. It is expected that the future months will show a decided falling off in shipments to the United States, as the new tariff is practically prohibitive for regular operations.

The zinc-mining interests of northern Mexico have united in a petition to the Federal railroad commission requesting a reduction in freight rates to the Gulf ports with a view to encouraging and permitting shipments of zinc ore to Europe. The present rail rates on zinc ore, as quoted by the National line, are as follows: In carloads to shipside Tampico, from Monterey, 6.90 pesos; from San Luis Potosi, 5.59 pesos; from Chihuahua, 9.72 pesos per 1000 kg. These rates control the rates for intermediate points which are all practically on a mileage-tonnage basis under the Mexican schedule system. The railroad rates in Mexico are controlled by a Federal commission, and it is in the power of this commission to grant this rate if it sees fit. Moreover, the government now practically controls all of the railroad lines of the country, and it can, therefore, exercise discretion in the matter which gives hope that the united efforts of the important zinc-mining interests may be successful.

Mexico is vitally interested in assurance of a continuation of Mr. Harriman's plans as to railroad building in the Republic. The important Guaymas-Guadalajara road is about two-thirds constructed and will assuredly be continued to completion. Most of the trunk-line roads in Sonora are likewise so far under way that no change in the program as to them is likely. However, it is not so certain about the fate of several branch lines and of the proposed line to the City of Mexico from Guadalajara and of the projected connection with the Pan-American road the Camp Bird can scarcely fail to meet to form a line from the United States to the Panama canal. These projects were supposed to be personally favored by Mr. Harriman, but his successors may see more important work to be done.

A corporation with $50,000,000 capital has been formed by J. M. Neeland, projector of the Pan-American railroad in Mexico, for the purpose of building a road in Central America to connect the terminus of the Pan-American at the southern boundary of Mexico with the Panama canal. Work will be started at La Union, Salvador, in January.

London

Sept. 10—Particulars have been published of a proposed transfer of the large claim area on the Rand, owned by the Rand Mines Deep Company and controlled by the Consolidated Goldfields of South Africa, Ltd., to the Rand Mines, Ltd., controlled by the house of Wernher Beit & Co. The property consists of over 1200 claims, lying immediately to the dip of the Nourse mines, Jupiter and Simmer Deep, the first of which is controlled by Wernher Beit & Co., while the other two mines are under the management of the Consolidated Goldfields. Taking into consideration the fact that the Consolidated Goldfields control by far the larger portion of the ground lying immediately above that owned by the Rand Mines Deep, it is surprising that the Goldfields should have allowed this ground to pass out of its hands and should not have kept it for extensions of the Jupiter and Simmer Deep. It is not known whether the Rand Mines Company has plans for working this deep ground by a separate company or companies, but having regard to the great depth of the reef on the Jupiter—over 4000 ft.—it does not seem probable that new shafts will be sunk. It is possible, of course, that an arrangement could be made with the Jupiter and the Simmer Deep for the shafts of the Rand Mines Deep, to be sunk on the ground of these companies and an approach made to the deep ground through inclines. However, what the policy is has not been disclosed and information on this point will be awaited with interest.

The last quarterly report of the Camp Bird, Ltd., states that an option has been taken on the mine in Mexico, which was recently recommended to the shareholders by John Hays Hammond and that R. J. Frecheville has made a report and is on his way home. The acquisition of the Mexican mine will have to be confirmed by the shareholders at a general meeting, but there can be little doubt that, if Mr. Frecheville's report is favorable, the mine will be purchased. The Camp Bird mine has been one of the most successful mining ventures ever put on the London market and any fresh business recommended by the engineers and directors will meet with support.

Mining News from All Parts of the World

New Enterprises, Installations of New Machinery, Development of Mines and Transfers of Property Reported by Special Correspondents

THE CURRENT HISTORY OF MINING

Alaska

Fairbanks—The Boone-Manley case, after four years' litigation, involving a partition of creek claims Nos. 4 and 5 below discovery on Cleary creek has been settled out of court.

Cleary Creek—The output this season will be $2,000,000. Ross Drennan has completed a tunnel to drain an underground reservoir. Claims No. 8, 9 and 10 below discovery have all been drained by it.

Nome—Gold Run will be worked on a big scale next year as water is being brought to it.

Bartels Tin—This company expects to produce ore next season according to William A. Hesse.

Rush & Brown and Mt. Andrew—These mines in the Ketchikan district shipped 1300 and 2500 tons respectively on Aug. 30.

Jerome Ledge—The test stamp mill, boiler and outfit on Jerome ledge in Bonnifield, belonging to Jerome Chute, was washed into Wood river by a cloudburst. The stamp mill was brought in over the trail last winter at great expense.

Arizona

COCHISE COUNTY

Tombstone Consolidated—The sulphide orebody, accidentally discovered on the 700- and 800-ft. levels, is holding out. Work on the pumps for the 800-ft. level is being pushed so as to resume work at the 1000-ft. level.

GILA COUNTY

Old Dominion—The Massachusetts supreme court has decided in favor of the company in the suit against A. S. Bigelow. A rehearing has been asked.

Inspiration—Plans are being considered to use steam shovels on the orebody disclosed in the Joe Bush shaft.

MOHAVE COUNTY

Tom Reed—Sinking operations have been suspended at 400 ft. on main shaft because of heavy water. The mine is at Signal.

Arizona Mines—Thirty stamps will be added to the mill. A triple compartment shaft is being sunk. The mine is near Kingman.

Hackberry—The Mammoth Silver Mining Company has made second payment of $10,000. The property is 20 miles west of Kingman.

PIMA COUNTY

Imperial—Copper-bearing porphyry has been discovered outside the orebodies and explorations are being made.

Twin Buttes—Hoist and compressor will be moved to new shaft. Ore is being shipped from 400-ft. level.

PINAL COUNTY

Copper Creek—The 250-ton concentrating mill is started and the shaft continued to 500 ft. The mine is near Mammoth, Bunker Hill district.

Troy-Manhattan—The property has been bought in at trustee sale by a committee of the stockholders. Work will be resumed.

SANTA CRUZ COUNTY

Ajax—Operations have been commenced in charge of Harold R. Bacon. The same company has the Oceanic. Both mines are in the Arivaca mountains and have been long idle.

YAVAPAI COUNTY

Arizona-Central—An electric hoist and pump for the Shylock mine are installed. The mine is in the Black Hills district.

YUMA COUNTY

New Planet—Examination preparatory to extensive explorations is being made.

Yuma Copper—Ore has been struck at 130 ft. The mine is near Vicksburg. Ernest A. Haggott, engineer.

California

BUTTE COUNTY

Carlisle—A wagon road is being built to Enterprise. The mill has begun operations.

Viloro Syndicate—The dredge was burned. It was between Palermo and Oroville.

Cherokee—This old gravel mine which years ago was a very large producer by hydraulicking, has been bonded to Alexander and E. C. Wilson who propose to operate the property as a drift mine.

EL DORADO COUNTY

Snow—Three shifts are working to open up the channel from the north side. The channel had been prospected by drills and the south rim located. The mine, which is near Newtown, is to be drifted.

Brandon—J. T. Reynolds at Brandon has purchased a 10-stamp mill.

Pacific—Men are at work reopening the mine at Placerville.

DEL NORTE COUNTY

Klamath River—C. A. Sample is arranging to open this gravel property near Requa.

MARIPOSA COUNTY

Tyro—The mine, near Coulterville, has been taken over by Joseph Buttenback and is being put in operation. It is equipped with a 10-stamp mill.

Ward—This group of mines at Pinon Blanco has recently been placed under bond to John C. Wilson, and men have been set at work. These mines have been idle many years but now that so many old mines are being opened it has come to the turn of the Ward group.

NEVADA COUNTY

Dana—Eighteen men have been set at work under Charles B. Smith, and excavations are being made for the machinery from the Sultana. The shaft will be sunk to 800 feet.

Native Son—Work will shortly be resumed at Blue Tent. J. H. Bishop, manager.

California—Thirty men are at work and the 10-stamp mill at Graniteville is running.

Golden State—Controlling interest has been purchased by J. T. Hennesey, Thomas Gill and others, and the property will be developed. The mine, near Grass Valley, is equipped with a 5-stamp mill.

Pittsburg—This old mine at Nevada City is being rapidly rehabilitated under the management of Mark B. Kerr. With the aid of the new compressor and pumping plant and the old Cornish pumps the water was taken out of the mine from the 800- to the 1000-ft. level in six days. Since the beginning of the reopening of the mine six months ago, a new electric hoist of great capacity, compressors, electric pumps, etc., have been added and the mill has been put in order. The entire unwatering of the mine has now been set at work on the 600- and 700-ft. levels of the mine.

SHASTA COUNTY

Balaklala Consolidated—The August output was: copper, 1,288,421 lb.; silver, 74,144 oz.; gold, 1746 oz. The cost of production for the month is reported as 8.82c. a pound for the copper, crediting the gold and silver against copper costs. This is an increase over July of about 20 per cent.

National—This mine at Buckeye was some years ago equipped with a mill and cyanide plant but it did not pay a profit and was finally permanently closed and abandoned. It was relocated by G. M. Sleezer, who has reopened it and is now shipping ore worth $24 per ton to the smelters at Mammoth. The presence of the smelters in that county has encouraged numbers of men to take hold of old properties which would not pay when individual reduction works were necessary for every mine.

SISKIYOU COUNTY

Diamond—G. W. Nickerson, superintendent, China Gulch, Salmon River district, reports a two-foot ledge carrying $23 rock.

TUOLUMNE COUNTY

Yrma—The company is working the old Josephine mine under bond, and has put up a Huntington mill to be followed with a 5-stamp mill.

Harvard—Sixty stamps are dropping and ore is being blocked out.

Eureka—The mill at Big Oak Flat has been started.

YUBA COUNTY

California Mother Lode Mining Company—Warren C. Wilkins, manager, is showing up a rich body of ore. An electric power plant and ten more stamps will be added to the equipment.

Onken—This mine, also known as the Eagleville, a low-grade proposition at Strawberry valley, has been purchased by Doctor Lund, of Willows, and Mrs. Nora Haines, of Oakland.

Colorado

BOULDER COUNTY

Lincoln—A cyanide plant will be erected at Sugar Loaf. N. M. Nelson, manager.

Tambourine—The cyanide mill at Wall Street, recently burned, will be rebuilt.

Colorado Metal and Reduction—A 50-ton mill will be erected near Arapahoe peak. The company's office is at Boulder.

CLEAR CREEK AND GILPIN COUNTIES

Crescent—The new mill at Georgetown is running. G. D. Parks, manager.

Sun and Moon—Lease and bond has been taken by O. W. Lowell, Idaho Springs.

Astor-Stewart—A concentration mill will be built at Georgetown.

Gilpin-Independence—Milling ore has been found at 250 ft. in the Golden Flint mine, Perigo, and the mill is now running. W. A. Scott, Gilpin, superintendent.

David—New equipment is being installed on Searle shaft, Willis gulch. Max Boehmer, engineer.

Champion—Operations will be resumed. L. D. Bloomer, Rollinsville, manager.

Dives-Pelican—A diamond drill will be used to tap the Seven-Thirty shaft from the Burleigh tunnel, now in 5900 feet.

Walsh—E. F. Clark, of Minneapolis, Minn., has purchased this property in West Argentine district.

Newhouse—The tunnel in the Central City district, reports the cutting of more veins of ore and of water. The depth below the surface is 1500 feet.

CHAFFEE COUNTY

It is reported that a strike of gold ore has been made east of Salida, which from local accounts has incited 500 people to go there in autos, carriages, horseback, and on foot, and well-dressed men and women are all busy staking claims, five square miles having been covered in this way, and silly statements of "$15,000 assays" are made. Reliable news is awaited with interest.

LAKE COUNTY—LEADVILLE

Robert E. Lee—Shipments of zinc have been started. A daily output of 75 tons is planned.

New Monarch—The main shaft, now 825 ft. deep, will be sunk to 1000 ft., and connections made with the Yak tunnel as soon as the lateral is extended.

O'Donovan-Rossa—A new company will continue development.

OURAY COUNTY

Atlas—A new compressor is being installed and driving continued on Klondyke vein. A strike of good ore has been made 1500 ft. from Atlas shaft.

Legal Tender—Ore has been found in shaft on contact to cut Mineral Farm blanket vein. Ned Canavan, superintendent.

SAN JUAN DISTRICT

Continental Mining Company—On the Buffalo Boy, Howardsville, 700 ft. has been driven, opening up an ore shoot 500 ft. long and 5 ft. wide. Ore developed, 40,000 tons. Shipments are continuing from Old Abe and Tenderfoot. A concentrator will be erected in the spring. Martin J. Heller, manager.

Bonner—Sale has been made to Lutz Mines Company, Pittsburg, Penn. New machinery will be installed. G. Grossman, Silverton, manager.

Champion—The Pittsburg tunnel has cut the vein 1800 ft. from portal. Property is operated by Ross Mining Company, Silverton.

Camp Bird—Mill crushed in June, 18,703 tons dry ore; receipts were $721,176 and working expenses $162,944. Number of feet driven 2193, feet in raises and winzes 90, cubic feet stoped, 131,000.

San Antonio—The Eastern stockholders of the company owning the Carbon Lake mine (in the Red Mountain district of San Juan), which is mining such a large body of enargite, or arsenical copper ore, visited the mine last week. The silver contents of the ore are increasing with depth, and the owners are so pleased with results that a big consolidation of Red Mountain properties is under consideration. T. M. Chestnut, of Denver, is the manager.

TELLER COUNTY—CRIPPLE CREEK

Cripple Creek District—The Trilby 75-ton cyanide plant has commenced the treatment of the low-grade ores of that mine and the Gold Sovereign, the high-grade ores being shipped to the valley mills as formerly. A sublease on the Shurtloff is reported to have shipped 5½ tons of ore that yielded 9½ oz. gold to the ton, this being from a narrow streak. Surface water from the late heavy rains is interfering with the lower workings of the Isabella, Pinto and others, which are usually dry mines, and a great deal of bailing has been done. Superintendent Hines, of the American Eagles, of the Stratton Estate, reports the discovery at the 1100-ft. level of a streak of kaolin or gouge on the footwall which runs 40 to 100 oz. gold per ton. This is being saved and sacked underground. The Cresson company, of Raven hill, managed by Richard Roelofs, produced about 30,000 tons of gold ore during the last fiscal year, the average value being $20 per ton.

Londonderry—Work will be resumed through the Wild Horse shaft of the United Gold Mines Company.

Jolly Tar—An important strike of quartz, carrying sylvanite and free gold in a phonolite dike in the granite, has been made. The property adjoins the Strong at Victor. J. B. Neville, manager.

Idaho

IDAHO COUNTY

Elk City—Two dredges are being erected on the placer deposits here.

Majestic—A tunnel 1½ miles long has been started to cut a vein at 3000 feet.

SHOSHONE COUNTY

Hercules—The mill in Gourge gulch, Burke, was burned Sept. 6. Loss, $100,000, no insurance. It will be rebuilt.

Idaho-Los Angeles—Alexander McDonald has been awarded the contract for the crosscut tunnel now in 1100 feet.

New Hope—Four feet of iron carbonates are visible in the face of the tunnel.

Great Western—A contract for a 250-ft. extension of the tunnel at Burke has been let.

Blanchard Smelting—Work has been commenced on the buildings for the 25-

ton preliminary installation. F. P. Machette is in charge.

Indiana

VERMILION COUNTY

United States Steel Corporation—This company will acquire the entire holdings of the Oakhill Mining Company, the Hammond Coal Company and the Deering Coal Company; the latter two are among the best known companies in Indiana, and the Oakhill company is one of the largest in the Clinton field. It is said that 29,000 acres of coal land are involved in the deal, and that the money to be paid for the land, mine tipples and fixtures is estimated at upward of $2,000,000. Edward Shirkie, president of the Oakhill Mining Company and one of the leading operators in the Indiana bituminous field, will still maintain an interest in the field. Mr. Shirkie and his brother, Hugh Shirkie, are the principal owners of the Atherton Splint Coal Company, south of Clinton, and have been buying extensive tracts of coal lands within a radius of five miles from Clinton. J. K. Deering and R. R. Hammond, of Chicago, and W. S. Bogle, of Clinton, have been closely associated with the Shirkies and have been, until recently, supplying much of the coal used by the United States Steel plants. A few months ago a reorganization took place in Chicago, which has never been well understood by the public, whereby the Brazil Block Coal Company became the selling agents for the Deering Coal Company, which had had trouble with the Steel Corporation over filling orders for "Steel coal" under a 50-year contract. It has been known for several months that the Steel company has been busy buying coal lands from farmers in the Clinton district, but the plan of acquiring the big coal companies and operating their properties directly had not been heard of until now.

VANDERBURG COUNTY

A three days' convention of union coal miners of southern Indiana was held in Indianapolis, Sept. 15-17. The object of the convention was to urge the miners to stand together and attempt to improve conditions for mining in the southern part of the State. Because they are brought into competition with nonunion diggers in Kentucky, the southern Indiana miners say their condition is not so satisfactory as that of miners in the Terre Haute district, and they are asking special recognition in scale and working conditions. The convention advocated a change in the mining laws of the State to permit the use of coal dust or wet slack for tamping shots where fireclay or other noninflammable material is not obtainable.

Kansas

CHEROKEE COUNTY

Degraff & Co.—The company, of Buffalo, N. Y., operating at Badger, has begun development work. Five drill holes show three runs of zinc ore.

Bonanza—An unusually shallow and rich run of zinc ore has been found at 28 ft. E. C. Matthews, Joplin, owner.

Omaha-Petersburg—The company owns 160 acres at Baxter Springs. The M. K. & T. mill has been purchased and started up.

McAllister—The property at Baxter Springs has been bought by L. Griffith for the Tennessee Metal Producing Company, Memphis. The mill is being increased and additional shafts sunk.

Common Law—The 40-acre tract at Baxter Springs has been purchased by T. F. Timothy.

Heap-O'Brien Company—The company has purchased a mill at Baxter Springs.

Michigan

COPPER DISTRICT

Larium—This company has encountered copper in its shaft on the Kearsarge. The lode shows a width from 12 to 15 ft. with stamp copper. This shaft is about 2600 ft. north of the Tecumseh on a tract of 275 acres.

Ahmeek—Sinking is going forward in the two new shafts. The stamp mill will be in shape to handle rock early the coming year. Shipments of about 2000 tons daily are being made.

Calumet & Hecla—Rock from the Osceola Amygdaloid lode will be sent to the Tamarack mills and the conglomerate rock to the Calumet & Hecla mills on account of the Tamarack mill being more efficient on the amygdaloid rock, and to avoid the necessity of changes to the mill.

La Salle—Preparations are being made to begin shipments from No. 1 Tecumseh shaft to the Allouez-Centennial mill.

Seneca—The crosscut from the 2nd level, 440 ft., has reached the Kearsarge lode, but no copper was found at intersection.

Oneca—The first drill hole is down 550 ft., and nearing the point where the formation should be encountered. The second hole is 100 ft. deep.

Lake—The crosscut from the 5th level shaft is in about 50 ft. and is nearing the point of intersection of the lode.

Section 12—A diamond drill outfit has started work on this property adjoining the Isle Royale on the south to expose the Baltic lode.

Isle Royale—Owing to the discontinuing of the handling of unproductive ground an increase of about 300 tons daily is being made to the mill. Shipments now averaging 1800 tons daily.

Atlantic—An assessment of $2 a share for development on Section 16 is likely.

IRON DISTRICTS

Richmond—The Consumer's Ore Company will use a steam shovel on this mine on the Cascade range.

Cundy—The report that this mine at Quinnesec would reopen is denied.

Vivian and Calumet—The Verona company, Charles E. Lawrence, manager, will reopen these mines at Quinnesec and Metropolitan, respectively.

Mary Charlotte—A new hoist and electric haulage will be installed. The mine is at Nagaunee.

Minnesota

VERMILION RANGE

Vermilion Lake—Ore is reported in 16-62-14, northeast of Tower, near Murray. The company is exploring.

Missouri

JOPLIN—ZINC-LEAD DISTRICT

American Zinc Lead and Smelting Company—The company is drifting from No. 5 shaft at the American Davey to No. 4, and will start up No. 4 as soon as the drift is completed.

Koh-i-noor—The mine on the Continental land west of Joplin has again become a producer yielding 10 to 20 tons of concentrates per day.

McGee—All records have been broken with a production of 243,000 lb. of silicate the first 10 days of September. The mine at Duenweg has only an 80-to mill.

Montana

BEAVERHEAD COUNTY

Gold Leaf Group—The property near Bannack is being worked under a lease by Dunn and Hand, sinking and drifting on the Wadam.

BUTTE DISTRICT

Butte-Milwaukee—Word has been received from New York that operations on the Colonel Sellers, near the North Butte, will be resumed. The shaft is down 700 feet.

Davis-Daly—Newman Erb, recently resigned from the board, is soliciting proxies for the Sept. 28 annual meeting.

Butte & Balaklava—The stock has recently been accepted for listing on the Boston Stock Exchange. The shaft is now down 1400 ft., the upper 500 ft. being two compartment and the lower 900 three-compartment. Work of making the entire shaft three-compartment will be begun about Oct. 1. Steel ore bins of 500-ton capacity are being erected and should be completed within a week.

Tuolumne—The management states that the returns on the first shipment of ore from the mine showed 8 per cent. copper and 4.6 oz. silver. The ore which has been mined so far has been taken from the sill floor of the 1400 level, but when the

east-end line of the property has been reached stoping will be begun, and it is expected that the values in the ore will materially increase. It should take about a month to reach the east-end line, and when stoping is begun the management is confident that production will average 300 tons daily.

Amalgamated—At the Butte & Boston Company's West Gray Rack mine, the raise, started from the 1100-ft. level of the adjoining East Grey Rock, to connect with the shaft of the West Grey Rock, is up 100 ft., and the 1000-ft. station has been cut. There is still another 300 ft. to go before the raise will be through to the shaft. At the Silver Bow mine operations will be suspended several days to overhaul the hoist.

GRANITE COUNTY

Crescent—The company owns eleven quartz claims on Stony Creek, 20 miles west of Phillipsburg. A 20-stamp mill is being erected on the property.

JEFFERSON COUNTY

Boston & Alta—The new shaft is now down 80 ft. Thirty-two men are employed.

MADISON COUNTY

Conrey Placer—The three dredges are now being operated by electricity. It is planned to put in a fourth in the spring. Charles Kammerer, Alder, manager.

Nevada

ESMERALDA COUNTY—GOLDFIELD

Combination Fraction—The new ore shoot is well exposed between the 300- and 425-f. levels and varies from 9 to 11 ft. in width. The discovery has increased the average of the mill ore from $27 to $40 per ton.

Red Top—This company, operating on the Red Top Extension territory, has installed a 30-h.p. electric hoist to replace the one burned. Drifting will be resumed on the 475-ft. level.

Florence-Goldfield—A discovery has been made east of Florence, main shaft and ore running $160 per ton uncovered.

ESMERALDA COUNTY—RAWHIDE

Kerns—The lease will be operated by W. B. Wedell, of Ogden, Utah, the owner.

Grutt-Balloon—Ore has been found at 250 feet.

Victor—Ore is being treated at the new 10-stamp mill.

Portland—A lode, supposed to be the Victor, has been cut. The property is on Hooligan hill.

ESMERALDA COUNTY

Horn Silver—J. W. Crane, on the Sunset claim, has made a shipment of 14 tons. The ore was extracted from a 100-ft. shaft and the grade $27 per ton.

NYE COUNTY

Kawich Consolidated—Upon the Mascot mine a 25-h.p. gasolene hoist has been installed and a 30-ft. gallows frame erected. The shaft is now 70 ft. deep and in milling ore.

Cotter—Sinking has been resumed from 360 to 400 feet.

Golden Arrow—The plant is to be remodeled and used for the treatment of ore from the Cornforth mine.

NYE COUNTY—ROUND MOUNTAIN

Round Mountain—The gross production for August was $34,000 and the average daily mill tonnage 103 tons, a monthly total of 3193 tons. The depth of the mine is 785 feet.

NYE COUNTY—RHYOLITE

Crystal-Bullfrog—The first brick from the mill has been shipped. The plates made an extraction of 70 per cent., but no clean-up has been made in the cyanide department. The mill is working custom ore.

Montgomery-Shoshone—About $50,000 is the gross production for August from 5800 tons.

STOREY COUNTY

Ward—The pump at the 2475 station recently broke down and endangered the mine. The water is 165 deg. F. and the difficulties of controlling the situation by bailing were great. Extensive improvements to the pumping system are under way. Whitman Symmes, superintendent.

WHITE PINE COUNTY—ELY DISTRICT

Ely Central—Work has commenced on shaft east of Copper Flat which will be sunk 550 feet.

Nevada Consolidated—Drills are at work near Liberty line and are opening up steam-shovel ground according to report.

New York

Garnet Company of America—The company is planning to work the garnet deposits at Fort Ann, shipping to Newark, N. J.

North Carolina

Mitchell County Mica—Nearly 2000 acres of mica lands have been sold to Mrs. V. P. Cibotti and Mrs. E. B. Thompson, of Washington, D. C.

South Dakota

BLACK HILLS DISTRICT

Branch Mint—James D. Hardin has purchased the mine at sheriff's sale. Resumption is planned and an electric railroad between Galena and Spearfish via Deadwood projected.

Custer Peak—A strike at the 250-ft. level is reported. John H. O'Brien, superintendent.

Gold Eagle—Work has been suspended pending the installation of machinery.

Utah

BEAVER COUNTY

Newhouse—The work of improving and enlarging the Cactus mill is progressing rapidly and operations should be under way again in a few weeks. It is probable that the tailings, which were rushed through the old mill at the time copper was high, will be reworked. The mine is being put in shape to meet the requirements of the new mill. The resumption is awaiting legal reorganization of the company.

SALT LAKE COUNTY

Thor—The company has been formed to operate claims at head of Big Cottonwood. W. I. Snyder, president.

Rexall—The tunnel is in 700 ft. and developing is being pushed. Gus Malmborg, manager.

Utah Metals—Electrical equipment for the Bingham properties will be ordered.

Utah Copper—The caving system will be used for the upper end of the McIntosh tunnel. Difficulty from high banks for steam-shovel work has been experienced in other parts of the mine.

Bingham Midway Mining and Milling—The company, with a capitalization of $1,000,000, has incorporated to operate a group of claims in the Bingham district. It has taken over twenty claims comprising 193 acres of patented lands, 200 acres under mineral location and 113 patented acres on option. John McDonald, of Bingham, is president.

TOOELE COUNTY

Consolidated Mercur—Earnings for six months prior to June 30, were only $3680, due to low-grade ore. The net earnings for the fiscal year were $34,005. The average daily tonnage was 773 tons, and average gold extraction, $2.70 from an ore averaging $3.58. The cost of leaching per ton was 41.4 cents.

Tooele Smeltery—This plant of the International company will be started Feb. 1. The contract for treating the Utah Consolidated ore commences March 1.

UTAH COUNTY

Picayune—The company has been incorporated at Provo to operate in Eldorado district near Payson. R. E. Knowlder, president.

Washington

FERRY COUNTY

Blue Flag—Operations have been resumed in charge of John E. Gautenbein.

SNOHOMISH COUNTY

Northwest Consolidated—An aërial tramway, 7000 ft. in length, is being built to the property located on Weeden creek, 2½ miles from Monte Cristo. L. H. Markham, Index, is manager of the mine.

Wisconsin

ZINC-LEAD DISTRICT

Koh-i-noor-Blende—A two-jig mill is being erected at Platteville. F. E. Kunz, secretary.

Peaceful Valley—Three shafts have sunk east of Beloit-Elmo, on Henry Kettler tract. H. L. Hulburt, manager, Cuba City.

Klar-Piquette—The churn drill cut 15 ft. of blende at 163 feet.

St. Rose—Development will be commenced on Seitz lease near Platteville.

Frontier—A run of blende is proven on the Sedgwick land near Benton. A two-jig mill will be built.

Fields—A three-jig mill is being built at Benton. R. S. Landers, superintendent.

Hoosier—A mill will be built three miles north of Vinegar Hill. J. H. Billingsly, manager.

Canada

BRITISH COLUMBIA

Granby Consolidated—The enlarged smelting plant will treat 4000 tons daily, and it is claimed will produce copper at a reduced cost.

Kootenay Development—The Silver King compressor and terminals recently destroyed by fire will be rebuilt. R. S. Lennie, Nelson, manager.

NOVA SCOTIA

Maratime Coal, Railway and Power—A contract has been let to the Canadian General Electric company for a 750-h.p. generator to be installed at Chignecto.

ONTARIO—COBALT

Silver Cliff—Work has been begun on the concentrator.

Chaplin—This property on Diabase mountain has been sold to the Meteor company and will be developed.

Union Pacific—The shaft on Peterson lake is down 85 feet.

Cobalt-Hydraulic—The 1000-ft. tunnel at Ragged Chutes was cut through, Sept. 11.

Northern Customs Concentrator—The plant is now running with good results.

John Black—A six-drill compressor has been installed and shaft will be continued to 200 feet.

Buffalo—The cyanide mill is in operation treating 50 tons daily. The sames are treated by mechanical and air agitation.

Pan Silver—The main shaft is down 200 ft., and from this level a winze is being sunk 20 ft., where another vein 8 in. wide has been discovered showing silver.

Ore Shipments—Shipments of ore from Cobalt for the week ending Sept. 11 were: Cobalt Central, 41,360; Crown Reserve, 189,630; Kerr Lake, 60,130; La Rose, 273,700; McKinley-Darragh, 42,810; Nipissing, 259,800; O'Brien, 64,450; total, 871,750 pounds.

Drummond—The new shaft is being sunk and water pumped from the old shaft, preparatory to continuing operations. The mine has been shipping to the Trout Mills concentrator.

Temiskaming—This mine will sink 50 ft. from the 300-ft. level. The concentrator will be completed by the end of the year.

ONTARIO

Doric Reserve Mines—This company, of which John R. Barber, Toronto, is president, owns 197 acres at the 77th mile post on the Temiskaming & Northern Ontario Railway. A vein yielding free-milling gold has been discovered and stripped for 160 ft. and is reported to assay very high.

ONTARIO—PORT ARTHUR DISTRICT

West Beaver—This property has been acquired by F. H. Keefer, who will proceed with development. The shaft is down 50 ft. in ore.

Mexico

CHIHUAHUA

Candaleria—Pumps are being installed to lift 5000 gal. per min. The mine is at San Pedro. George D. Laird, manager.

Compañia Minera de Peñoles—This company, which operates a large lead smeltery at Mapimi, Dgo., has obtained control of several properties in the Parral district, including La Perla group, La Resolana and the Dewey. Additional men have already been put at work at La Perla group, near the Maturana station on the Mexican Central.

Reina de Plata—Development and productive operations will be resumed soon at this Santa Eulalia company's properties, of which Capt. Linday Brown is manager.

Rio Tinto—Diamond-drill exploratory work is under way at the Verde mine at Terrazas.

Inglaterra—The English company has lately acquired the Cocinera and Concepcion, adjoining Santa Eulalia.

GUANAJUATO

Guanajuato Power—A new plant will be built on Angulo river to generate 20,000 h.p. additional. The company now distributes through an area 200x100 miles. Norman Rowe, Guanajuato, manager.

MEXICO

Seguranza—The mill at Zacualpan has not yet completed the cyanide installation. Power from Sultepec awaits transmission line.

El Oro—August production was $215,120 and the net profit $78,300 from 24,183 tons of ore. The railroad net earnings were $12,000.

OAXACA

San Juan—Denny Brothers are making an examination of this mine in Taviche for English interests.

PUEBLA

Teziutlan—The building of the railroad from Teziutlan to Nautla, a port midway between Veracruz and Tampico, is now assured. This will give a direct outlet for the large copper mines at Teziutlan.

SONORA

Greene-Cananea—Generators for central power are delivered. It will be three or four months before the installation is completed.

Cieneguita—The smelter has closed on account of rainy season and only development work is under way. H. A. Walton has been appointed manager.

ZACATECAS

Asturiana—Option on this mine on the Veta Grande and Los Campos, near Guadalupe, has been given George A. Wadill, of San Luis Potosi.

South America

ARGENTINE

Famatina—The furnace is treating 140 tons per day. Ropeway is now in use bringing down Upulungos and San Pedro ores. Briquetting machinery is being installed. Mine is in Rioja province.

South Africa

Nigel and Sub Nigel—Some time back an amalgamation was proposed by the Consolidated Goldfields of South Africa, but the terms were opposed by the shareholders of the Nigel Deep and the scheme was defeated. A new scheme has now been put forward, giving the Nigel Deep shareholders somewhat more favorable terms. The Nigel Deep Company owes a large sum to the South African Gold Trust and the Gold Mines Investment Company, companies controlled by the Consolidated Goldfields, and it is announced that these companies will, unless the new scheme is adopted, call in their loans, a proceeding which would force the Nigel Deep Company into liquidation, resulting probably in a total loss for the Nigel Deep shareholders.

Metal, Mineral, Coal and Stock Markets

Current Prices, Market Conditions and Commercial Statistics of the Metals, Minerals and Mining Stocks

QUOTATIONS FROM IMPORTANT CENTERS

Coal Trade Review

New York, Sept. 22—The coal trade in the West continues to show increased activity at all the larger centers. The demand for steam coal is evidently improving. The gain is good notwithstanding the dullness of the Lake trade. Dealers do not understand the present slowness of the Northwest in taking coal and say that there must be a rush up the Lakes in October or else heavy winter rail shipments.

The Eastern bituminous trade improves more slowly, though there is a gain evidently. Operators generally are encouraged and predict an active fall business.

The anthracite trade pursues its usual course with little variation. Operations at the collieries are not yet on full time. The working conditions are a little better, some rain having fallen so that water supplies are more abundant through the region.

Lehigh Coal and Navigation—There is still active buying of this stock in Philadelphia. It is known to be for New York account, but it is uncertain who the buyer is. All sorts of reports are current, the most persistent being that the New Haven company is seeking control.

Coal Traffic Notes

Coal and coke tonnages originating on Pennsylvania railroad lines east of Pittsburg and Erie, year from Jan. 1 to Sept. 11, short tons:

	1908.	1909.	Changes
Anthracite	3,512,441	3,318,497	D. 193,94
Bituminous	22,657,420	25,014,474	I. 2,357,054
Coke	4,752,098	7,304,421	I. 2,552,32[illegible]
Total	30,921,959	35,637,392	I. 4,715,433

The total increase this year to date was 15.3 per cent.

Coal shipments reported by Monongahela River Consolidated Coal and Coke Company for the nine months of its fiscal year from Nov. 1 to July 31, short tons:

	1908.	1909.	Changes.
River coal	3,979,679	3,719,995	D. 259,684
Rail coal	1,018,450	714,705	D. 303,745
Total	4,998,129	4,434,700	D. 563,429

The total decrease this year was 11.3 per cent. The great part of the loss was in rail coal.

Coal tonnage passing through Sault Ste. Marie canals, season to Sept. 1, short tons:

	1908.	1909.	Changes.
Anthracite	901,335	797,545	D. 103,790
Bituminous	4,895,403	4,803,168	D. 92,235
Total	5,796,738	5,600,713	D. 196,025

The total decrease this year was 3.4 per cent. The loss was in both anthracite and bituminous coal.

Coal receipts at Boston, eight months ended Aug. 31, reported by Chamber of Commerce:

	1908.	1909.	Changes.
Anthracite	1,401,282	1,103,518	D. 297,764
Bituminous	2,188,064	2,303,662	I. 115,598
Total domestic	3,589,346	3,407,180	D. 182,116
Foreign	357,705	167,454	D. 190,251
Total	3,947,051	3,574,634	D. 372,417

The foreign coal comes almost entirely from the Nova Scotia mines.

Anthracite coal shipments in August were 4,198,273 long tons, being 177,508 tons more than in July, but 400,820 tons less than in August, 1908. For the eight months ended Aug. 31, the shipments were, in long tons:

	1908.	1909.	Changes.
Reading	7,787,232	7,561,471	D. 225,761
Lehigh Valley	7,143,440	6,654,551	D. 488,889
N. J. Central	5,475,650	5,071,927	D. 403,723
Lackawanna	6,601,398	6,210,121	D. 391,277
Del. & Hudson	4,188,863	4,205,400	I. 16,537
Pennsylvania	3,833,603	3,719,715	D. 113,888
Erie	4,887,882	4,929,627	I. 41,745
N. Y., Ont. & West.	1,890,973	1,817,956	D. 73,017
Total	41,809,041	40,170,768	D. 638,273

The total decrease was 1.5 per cent. Two companies—the Delaware & Hudson and the Erie—showed small gains; the other companies had decreased shipments.

New York

Anthracite

Sept. 22—There is no change in the market, the usual demand being easily satisfied, while the fall business has hardly set in yet. The Hudson-Fulton celebration has served to postpone the question of winter stocks.

For domestic sizes schedule prices are $4.75 for lump and $5 for egg, stove and chestnut, f.o.b. New York harbor. For steam sizes quotations are unchanged, as follows: Pea, $3.15@3.25; buckwheat, $2.35@2.50; No. 2 buckwheat or rice, $1.70 @2; barley, $1.35@1.50; all f.o.b. New York harbor.

Bituminous

There seems to be no material change in the Atlantic seaboard soft-coal trade. Slightly improved conditions continue to prevail and a little better tonnage is being produced. Prices vary according to needs of operator and consumer.

Trade in the Far East continues to call for a little more coal than in previous months; fall business is beginning to show in this way and also in the shoalwater ports, that are working to get winter stocks on hand before ice forms. Trade along the Sound exhibits a slightly improved demand, and although prices as a whole are unchanged, there is some improvement here and there where necessities arise. New York harbor trade shows an increase as the Hudson-Fulton celebration has created demand, warships and electric-light concerns calling for quite a block of coal.

Transportation is a little better than last week, although not yet quite up to schedule, and variable according to the individual roads. Car supply is practically up to demand, although the rules governing this matter, as applied on some of the lines, are very irritating to shippers when enforced to the limit.

The coastwise vessel market continues to show a good supply of ships at lower rates. Brokers are, however, beginning to talk of winter rates. New York harbor quotes on small-class vessels 50c. around the Cape, with 5 to 15c. higher to special points. Philadelphia quotes on large vessels 60@65c. to Boston, Salem and Portland, 65@70c. to Portsmouth, 70@75c. to Lynn, and 75@80c. to Newburyport.

Birmingham

Sept. 21—Several coal mines in the Birmingham district will resume operations in the next few weeks, and coke ovens will be started up. The Birmingham Coal and Iron Company will put 100 coke ovens in operation. The general coal trade is improving. The railroads in this State are beginning to get all empty cars off the sidings and run them to the larger centers to be ready. More cars are being handled by the railroads than for nearly two years.

Chicago

Sept. 20—Conditions in the wholesale coal market continue good from the dealer's point of view. All kinds of bituminous, except screenings, are in large and increasing demand. Many consumers and retailers are laying in stocks of domestic coals, and steam supplies are every day more in demand. Supplies are well adjusted to consumption on the chief supply of the market, Western bituminous; on some smokeless there is occasionally a sale at an exceptionally low price to escape demurrage charges. Otherwise the market is practically free from over-shipments.

Lump from Illinois and Indiana mines brings on cars $1.75@2.40 for the most part, some few shipments bringing 20@25c. more. Run-of-mine sells for $1.60@1.75, and screenings hold to $1.20@1.45. Lump and run-of-mine prices, probably, will advance slightly.

Smokeless is in good demand and prices are stiffening, the greater part of the Pocahontas and New River received selling at $3 for run-of-mine and $3.55 for lump. On demurrage sales these prices are occasionally cut by as much as 15c. Hocking is firm at the recently advanced price, $3.05. Pittsburg No. 8 at $2.55 for ¾-in., and Youghiogheny at $3.15 for ¾-in. gas, are quiet and firm.

Anthracite also is in increasing demand, though not active, and there is still some selling at cut prices. Consumers generally are laying in supplies of anthracite early, especially in the country.

Cleveland

Sept. 21—The Lake trade is dull and there is no sign yet of the rush that was expected in September. It has been postponed to next month—if it comes at all. Local trade, on the other hand, is very active, and deliveries are being rushed, both on steam and domestic coal.

Current prices show little change. For steam coal, No. 8 district sells at $1.90@2.05 for lump, $1.70@1.80 for run-of-mine and $1.35 for slack; Middle district is about 10 or 15c. lower; Pittsburg, $2.10@2.25 for lump, $2@2.05 for run-of-mine and $1.15 for slack. For domestic coal, Massillon lump brings $2.95, f.o.b. Cleveland.

[Indianapolis

Sept. 21—A distinctly stronger undertone was displayed in the past week's coal trade. Improvement in the demand and an enlargement of the output of the mines were reported from all sections of the mining territory. The present demand for coal is normal, and there is little doubt that it will continue to pick up for the next few weeks. One new mine, the Epworth, was opened in the first district near Evansville during the week; it will employ about 400 miners.

Pittsburg

Sept. 21—Demand for coal has continued to improve and mining operations are at the highest point in the year. Prices have stiffened and substantially the full official prices are being obtained, with prospects of the usual season advance within a short time. Meanwhile the market is quotable at $1.10 to large consumers and $1.20 to retail dealers for mine-run at mine, with slack at 65c. at mine.

Connellsville Coke—The market is highly excited. Coke is scarce and prices have advanced by leaps and bounds. Several furnaces had difficulty in obtaining coke to run over Sunday, and bids of $2.50 and even higher have been made for prompt furnace coke without bringing out any material. Occasionally odd lots are picked up at $2.50, for but any regular supply for the near future $2.75 has to be paid. Inquiry for next year is heavy, and it is reported that many furnaces have made firm offers of $2.75 without getting the material. Some operators are predicting $3 for next year and do not seem to care to sell until that figure is reached. Foundry coke is quotable at about 25c. over furnace coke.

We quote furnace coke at $2.50@2.75 for prompt and fourth-quarter and at $2.75 for next year, with foundry coke nominally at about $2.75 for this year and $3 for next year.

The *Courier* reports the production in the region in the week ended Sept. 11 at 424,568 tons, or within 5000 tons of the greatest weekly production ever reported, in 1907. Shipments are reported at 5201 cars to Pittsburg, 7522 cars to points west of Pittsburg and 818 cars to points east of Connellsville, a total of 13,541 cars.

St. Louis

Sept. 18—The market is stiffening up all around. All the mines in southern Illinois have been practically tied up on account of car shortage, consequently high-grade coal has advanced in price and is scarce. This has been very beneficial to the lower-grade mines in the Central district, which are getting a better price and have a good supply of cars. On the whole the mines in southern Illinois on the Iron Mountain and Illinois Central did not average more than two days last week. The relief promised by the railroad officials did not materialize.

Carterville 6-in. lump or egg is now bringing $1.30@1.40 per ton f.o.b. mines, or $1.97@2.07 f.o.b. St. Louis; 3-in. nut is $1.10 f.o.b. mine, or $1.77 f.o.b. St Louis. Nut coal seems to be more plentiful this week than it has been for the past month. Franklin county coal brings 15 or 20c. per ton more than Carterville.

Standard coal brings $1@1.10 per ton f.o.b. mines, or $1.52@1.62 f.o.b. St. Louis for 6-in. lump; 3-in. lump is 90c. f.o.b. mine, or $1.42 f.o.b. St. Louis, and nut is worth about 55c. per ton f.o.b. mine, or $1.07 St. Louis. All the mines in the Standard district are practically operating to full capacity now. Staunton, Mt. Olive and Springfield district coals are about $1.25 f.o.b. mine, or $1.77 St. Louis for 6-in. lump, with 3-in. lump 5c. less.

Screenings have eased off a little more this week, though they are being absorbed readily at about 30c. per ton f.o.b. mines for Standard, and 45c. per ton f.o.b. mines for Carterville.

Anthracite coal is now moving readily. Dealers are complaining for the first time this year that they are not getting their coal as promptly as they should. Several of the large local jobbers report that since Sept. 1 the mines have fallen back on orders.

Foreign Coal Trade

United States Coal Exports—Exports of coal and coke from the United States, with coal furnished to steamships in foreign trade, seven months ended July 31, long tons:

	1908.	1909.	Changes.
Anthracite	1,587,299	1,709,401	I. 122,102
Bituminous	4,837,677	4,915,914	I. 78,237
Total exports	6,424,976	6,625,315	I. 200,339
Bunker coal	3,523,026	3,538,219	I. 15,193
Total	9,948,002	10,163,534	I. 215,532
Coke	368,392	547,434	I. 179,042

Canada took this year 1,685,395 tons anthracite and 3,424,795 tons bituminous; 5,110,190 tons, or 77.1 per cent. of the total exports. The coke went chiefly to Mexico and Canada.

United States Coal Imports—Imports of coal and coke into the United States, seven months ended July 31, long tons:

	1908.	1909.	Changes.
Anthracite	15,023	3,145	D. 11,878
Bituminous	912,820	636,939	D. 275,881
Total coal	927,843	640,084	D. 287,759
Coke	73,307	111,065	I. 37,758

Canada furnished this year 543,198 tons of coal and nearly all the coke; Australia, 75,429 tons of coal. Imports are chiefly on the Pacific coast, and in the northwestern States—Montana, Idaho and Washington.

Welsh Coal Prices—Messrs. Hull, Blyth & Co., London and Cardiff, report current prices of coal as follows, on Sept. 11: Best Welsh steam, $4.32; seconds, $4.08; thirds, $3.84; dry coals, $4.08; best Monmouthshire, $3.54; seconds, $3.36; best small steam, $2.22; seconds, $1.80. All per long ton, f.o.b. shipping port.

Iron Trade Review

New York, Sept. 22—The iron and steel trades continue to show activity and in some directions there is almost a boon.

This is especially the case in pig iron. In the Central West there has been large purchasing of bessemer and basic pig, indicating that some of the steel companies expect a greater demand than their own blast furnaces can supply. Bessemer pig has accordingly shown a sharp advance, as high as $17.50 having been paid for iron in the Shenango Valley for 1910 delivery. Basic has shown a parallel advance. In eastern territory there has been less activity in basic iron, but foundry sales have been large and also at advancing prices.

In finished material orders have been so heavy that there is some talk of a possible scarcity of steel and of delayed de-

liveries latter. This, however, is advancing matters a little. Prices are generally firm and small advances are noted in bars and in structural material. Special activity has been evident in rails, orders for something like 300,000 tons for next year's delivery having been placed during the week. While 1909 rail business has been small, the mills will begin next year with a very good quantity of orders on hand.

There are some reports of the placing of orders for basic pig iron in Germany, and it is rumored that quite a large tonnage has been taken there. This, however, must be accepted with considerable caution.

Lake Superior Iron Ore—Shipments of iron ore from the Lake Superior region in August were 7,193,199 long tons, being 500,174 tons more than in July. For the season to Sept. 1 the total shipments by ports are reported by the Cleveland *Iron Trade Review* as below, in long tons:

	1908.	1909.	Changes.
Escanaba.....	1,351,513	3,053,845	I. 1,702,332
Marquette.....	625,399	1,413,568	I. 788,169
Ashland.....	1,037,185	1,700,769	I. 663,584
Superior.....	1,723,208	3,686,323	I. 1,963,115
Duluth.....	4,583,987	7,713,377	I. 3,129,390
Two Harbors.....	2,663,644	5,020,667	I. 2,357,023
Total.....	11,984,936	22,588,549	I. 10,603,613

The port statements indicate that the larger part of the increase this year came from the Mesabi range.

Baltimore

Sept. 21—Imports for the week included 1937 tons ferromanganese, 100 tons silicospiegel and 2300 tons manganese ore from Great Britain; 17,350 tons iron ore from Cuba. Exports included 1,112,200 lb. steel billets to Copenhagen and 1,138,100 lb. pipe to Antwerp.

Birmingham

Sept. 21—The Southern iron market shows sales steady and of some size, while inquiries are being received right along for iron to be delivered into the first half of next year. No. 2 foundry is now selling at $14.50 per ton. Some of the furnace companies in this territory have withdrawn from the market, their probable make being pretty well sold up. Two furnaces have gone into blast this month. The Southern Iron and Steel Company is rapidly getting ready for a general resumption at all plants, furnaces, coke ovens, quarries and steel plant. The cast-iron pipe makers are still busy. The machine shops and foundries are receiving more work every week. It is announced that the American Radiator Company, which recently established a small factory here, will enlarge the works. The iron manufacturers are beginning to talk of $15 per ton for No. 2 foundry iron, delivery next year and a sale or two has already been made. Charcoal iron is in strong demand, the car wheel manufacturers having much business.

Chicago

Sept. 21—The iron market continues strong, with steady purchases of pig iron by foundrymen, generally, in medium-sized lots—300 to 1000 tons—and occasionally a larger sale. Both Northern and Southern coke iron are sought now chiefly for first-quarter needs; some sales extend over the whole first half of 1910. Northern continues to command $18.50 for both last-quarter and first-half delivery. Southern is no longer obtainable at a discount price for early delivery, the minimum holding to $14 Birmingham, or $18.35 Chicago. Northern charcoal is in very good demand at $19.50@20 per ton.

Confidence in the continuation of the existing large demand for pig iron and iron and steel products of all kinds is everywhere manifested. With no indications of an attempt to buy recklessly, melters and manufacturers are buying liberally, while the railroad demands continue strong for supplies of every kind. That pig iron will advance is prophesied by most sellers and many buyers, while advancing prices on manufactured products do not seem in any way to check consumption. Coke continues active, selling largely at $4.85, and being in plentiful supply.

Cleveland

Sept. 21—Small orders for iron ore are still coming in, though most of the larger contracts have been closed. Prices are unchanged.

Pig Iron—Foundry iron is quieter, but basic is in better demand. Prices are going up, and there is quite a range, depending mainly on time of delivery. No. 2 foundry is $16.75@17.25; gray forge, $15.25@15.50. There is quite a call for Lake Superior charcoal at $19.50@20, Cleveland.

Finished Material—Bars are quieter, but plates are active, and a number of orders for structural steel are pending. Small trade is active and jobbers have advanced prices, quoting 2c. for structural steel and 1.80c. for bars out of stock.

Philadelphia

Sept. 22—The pig-iron market has not developed during the past few days anything worth noting. Users of basic pig have purchased liberally during the past few weeks. Much more could be sold if the furnaces had it to spare. The next anticipated move is the placing of orders with Western basic makers for iron for delivery during the winter. The current quotation today is $18 with probabilities of a further advance. Foundry iron has gained in strength, but not in activity, and is quoted today at $18.50 for No. 2X. It transpires that many of the larger consumers of No. 2 foundry are not very well supplied. Gray forge iron has been quiet. Southern iron is being offered here at $17.50 for No. 2 Inquiries for late deliveries develop firm prices.

Scrap—Only the heavier kinds of scrap are meeting with any demand worth noting. Old rails have been asked for this week, and heavy cast scrap is cleaned up in several yards. Nothing is being done in railroad scrap at present.

Pittsburg

Sept. 21—The iron and steel markets show an even more rapid improvement than formerly; it appears now to be a genuine bull movement, with prospects for continued improvement in prices and tonnage for several months to come. Specifications on old contracts for finished steel continue excellent, while new buying is on the increase, and many steel interests are making new records for the year in bookings.

The trend of prices continues upward. Plates and shapes have advanced $2 a ton in a fortnight, and are quotable at a minimum of 1.50c., steel bars remaining at 1.40c. On desirable business mills will sell for first quarter at these figures, but not for later delivery. Sheets are still firmer. Tinplate premiums have largely disappeared, but it is regarded as certain that prices will be advanced for next year. While wrought-iron pipe has steadily advanced, steel-pipe prices have not changed and as it is late in the season nothing may now be done for awhile, despite the fact that iron pipe is six points, or practically $12 a ton, above steel pipe.

Pig Iron—Bessemer has continued to lead the pig-iron market. Last Thursday the market quietly advanced 50c. to $17.50, Valley, and since then sales have been made of 20,000 tons to the Lackawanna Steel Company, 10,000 tons to the Republic Iron and Steel Company and 3000 tons to the Midvale Steel Company, all at $17.50, Valley, for fourth-quarter delivery. Except as to some iron which has been under negotiation between a Youngstown steel interest and the Valley furnaces, and perhaps a few odd lots, the $17.50 price has been withdrawn and the market is fairly quotable at $18, Valley, for any delivery this year, and with the prospect that first-quarter deliveries will bring higher figures. September opened with bessemer iron at $16.75, Valley, and to date the sales actually reported, with details, total about 125,000 tons, with an advance of $1.25. Other grades of iron have followed the lead of bessemer. No. 2 foundry has advanced 50c. to a minimum of $16.50, Valley, for this year, while it is not certain that $17 can be done for first quarter. Forge is nominally about 75c. under No. 2 foundry. The National Car Wheel Company has bought a round block for first half at $16.50, furnace. Sales of foundry iron have been fairly large, but there has been no movement in basic since the bessemer advance. Last week $16 was quoted in this report while

in the absence of sales $16.50@17 may be quoted as nominally representing the value of basic.

Ferromanganese—The market has been fairly active, with prices advancing, and quotable at about $42.50 for prompt, $44 for fourth quarter and $45 for first quarter, all at Baltimore, the freight to Pittsburg being $1.95 per ton.

Steel—The scarcity in unfinished steel has become more acute, and it is not easy to arrange purchases at any prices. Quotable prices, largely nominal, are: Bessemer billets, $25.50; open-hearth, $26; sheet-bars, $26.50@27; bessemer rods, $31.50; open-hearth rods, $32, all at mill, plus full freight to destination.

Sheets—The market has gained. Mills are well sold up and seem to be averse to making further commitments, on account of the advance in sheet-bars and the possibility of a definite advance in sheets. The market is firm at 2.20c. for black and 3.25c. for galvanized, with corrugated roofing at $1.55 per square for painted and $2.80 for galvanized.

St. Louis

Sept. 18—The pig-iron market is very active and prices remain unchanged at $14 per ton Birmingham or $17.75 St. Louis. Local agents report inquiries numerous and several of the large companies have sold up their entire output for all of this year and have taken on all the business for the first quarter of next year they care about. Consequently they are turning down all orders. They report that they anticipate an advance of at least $1 per ton by the first of the year.

Iron Ore—The demand for 55 per cent. iron ore is steady and strong at $3.30@3.75 per ton f.o.b. St. Louis; production does not seem to be quite up to the demand. Another indication that the iron business is picking up is the increased demands for foundry coke, which is firm at $5.25 per ton f.o.b. St. Louis.

Foreign Iron Trade

German Iron Trade—Imports and exports of iron and steel in Germany, seven months ended July 31, metric tons:

	Exports.	Imports.	Excess.
Iron and steel....	2,216,777	257,402	Exp.1,959,375
Machinery.....	182,477	45,183	Exp. 137,294
Total.....	2,399,254	302,585	Exp.2,096,669
Total, 1908.....	2,437,518	378,719	Exp.2,058,799

Imports of iron ore for the seven months were 4,460,237 tons; exports, 1,564,287 tons. Imports of manganese ore, 234,691; exports, 2284 tons.

Iron Ore Imports—Imports of iron ore into Great Britain for the seven months ended July 31, were 3,467,235 long tons.

Metal Markets

New York, Sept. 22—The metal markets generally show little change, though there are some indications of increasing consumption. Prices are generally unchanged, or show only moderate fluctuations.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal.	Exports.	Imports.	Excess.
Gold:			
July 1909..	$16,661,782	$ 3,269,885	Exp. $13,391,897
" 1908..	4,845,272	2,949,179	Exp. 1,896,093
Year 1909..	80,496,119	23,405,477	Exp. 57,090,642
" 1908..	58,363,098	29,357,075	Exp. 29,006,172
Silver:			
July 1909..	5,049,366	3,926,117	Exp. 1,123,249
" 1908..	4,930,746	3,039,581	" 1,891,165
Year 1909..	34,409,032	26,798,145	" 7,610,887
" 1908..	30,445,291	24,180,929	" 6,264,362

Exports from the port of New York, week ended Sept. 18: Gold, $25,260; silver, $792,910, chiefly to London. Imports: Gold, $75,368, principally from South America; silver, $48,691, from the West Indies and Mexico.

Gold production in the Transvaal in August was 611,537 oz., making for the eight months ended Aug. 31 a total of 4,868,989 oz., or $100,642,003. This is an increase of 296,764 oz. over last year.

Gold—The price of gold on the open market in London remained at the standard, 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American coin. The chief demand just now is from Berlin, which has been sending a large amount to Russia. In New York no gold exports are reported.

Platinum—Demand is good, especially for the jewelry trade. The recent advance in prices is well held, dealers quoting $25.50 per oz. for refined platinum and $29.25 per oz. for hard metal. There is some talk of a further advance.

Silver—The market has been unusually steady, only one change having occurred during the week. It closes at 23 11/16d. in London.

SILVER AND STERLING EXCHANGE

Sept.	16	17	18	20	21	22
New York....	51⅛	51⅛	51⅛	51⅛	51⅛	51⅛
London . ..	23¾	23¾	23¾	23¾	23¾	23 11/16
Sterling Ex..	4.8615	4.8605	4.8610	4.8615	4.8615	4.8615

New York quotations, cents per ounce troy, fine silver; London, pence per ounce sterling silver, 0.925 fine.

Exports of silver from London to the East, Jan. 1 to Sept. 9, as reported by Messrs. Pixley & Abell:

	1908.	1909.	Changes.
India.....	£ 6,458,533	£4,343,800	D. £2,114,733
China.....	516,400	1,555,200	I. 1,038,800
Straits.....	90,510	82,800	D. 7,710
Total.....	£ 7,065,443	£5,981,800	D. £1,083,643

Receipts for the week, £5000 from Mexico, £2000 from the West Indies and £212,000 from New York; total, £219,000. Exports, £27,500, to India.

Exports of copper from New York and Philadelphia for the week were 5614 long tons. Our special correspondent gives the exports from Baltimore at 486 long tons.

Copper, Tin, Lead and Zinc

Sept.	Copper. Lake, Cts. per lb.	Copper. Electrolytic, Cts. per lb.	Copper. London, £ per ton.	Tin. Cts. per lb.	Lead. New York, Cts. per lb.	Lead. St. Louis, Cts. per lb.	Zinc. St. Louis, Cts. per lb.
16	13 @13⅛	12¾ @13	58⅞	30⅜ @30¼	4.32½ @4.35	4.20 @4.22½	5.60 @5.62½
17	13 @13⅛	12¾ @13	58⅞	30¼ @30⅜	4.32½ @4.35	4.20 @4.22½	5.60 @5.62½
18	13 @13⅛	12¾ @13	....	30¼ @30½	4.32½ @4.35	4.20 @4.22½	5.62½ @5.65
20	13 @13⅜	12¾ @13	59	30¼ @30½	4.32½ @4.35	4.20 @4.22½	5.65 @5.67½
21	13 @13⅜	12¾ @13	59¼	30⅜ @30¼	4.32½ @4.35	4.20 @4.22½	5.65 @5.70
22	13 @13⅜	12 @13¾	59⅜	30⅜ @30⅜	4.32½ @4.35	4.20 @4.22½	5.67½ @5.70

London quotations are per long ton (2240 lb.) standard copper. The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis, New York, cash. The prices of casting copper and of electrolytic cathodes are usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands: special brands command a premium.

Copper—In spite of a further increase in the European visible supply for the first half of this month of 2000 tons, there has been an excellent inquiry from abroad, due to a decided revival in the business of the European consumers. Large sales have been made for export, and domestic consumers, when they found that the market would yield no further, also took hold on a more liberal scale. While the market has advanced somewhat, the demand has been freely met, the close being steady at 13@13⅜c. for Lake copper, and 12¾@13c. for electrolytic copper in cakes, wirebars, or ingots. Casting copper is quoted nominally at 12⅝@12⅞ cents.

Copper sheets are 17@18c., base for large lots. Full extras are charged, and higher prices for small quantities. Copper wire has been reduced ½c. and is now 14½c. base, carload lots at mill. Business continues on a good scale.

The standard market in London reflected the better feeling and advanced gradually during the week 15s. for both options, the close being steady at £59 7s. 6d. for spot, £60 5s. for three months.

Refined and manufactured sorts we quote: English tough, £62 10s.; best selected, £61 10s. @ £62 10s.; strong sheets, £73 10s. @ £74 10s. per ton.

Tin—A large buying movement developed early in the week, which quickly absorbed the parcels offering at less than the importation point. The feeling of both speculators and consumers is more friendly to the market, and a good business has taken place from day to day. London closes firm and higher at £138 for spot, and £139 2s. 6d. for three months, while business here is being done at 30⅛@30⅜c., f.o.b., New York.

Lead—The market is quiet and unchanged at 4.32½@4.35c., New York, and 4.20@4.22½c., St. Louis.

The London market has fluctuated within narrow limits, and closes steady at £12 12s. 6d. for Spanish lead, and £12 15s. for English lead.

Spelter—Under a relatively light demand from consumers, the market has advanced almost from day to day. Smelters are selling only their current production, as ore prices are still out of all proportion to the value of the refined metal. The close is steady and higher at 5.82½@5.85c. New York, and 5.67½@5.70c. St. Louis

New York quotations for spelter on Sept. 16 and 17 were 5.75@5.77½c.; 18, 5.77½@5.80c.; 20, 5.80@5.82½c.; 21, 5.80@5.85c.; 22, 5.82½@5.85 cents.

The London market is unchanged at £23 for good ordinaries and £23 5s for specials.

Base price of sheet zinc is now 7½c. per lb., f.o.b. La Salle-Peru, Ill., less 8 per cent. discount.

Other Metals

Antimony—Business is quiet and prices are steady at 8⅝@8¾c. for Cookson's; 8⅜c. for Hallett's; 8@8¼c. for U. S., and 7⅞@7⅞c. for outside brands.

Aluminum—No change in the market. No. 1 ingots can be had at 20@23c. per lb. in large lots, with the American maker holding to the higher figure.

Quicksilver—The market has been active and current supplies are virtually cleaned out. The New York price has advanced sharply to $46 per flask of 75 lb. Jobbers quote 63@65c. per lb. for small lots. San Francisco prices have advanced to $44@45 for domestic orders and $42@43 for export. The London price is now £8 5s. with jobbers quoting £8 per flask.

Magnesium—The price of pure metal has been advanced 25c. to $1.50 per lb. for 100-lb. lots f.o.b. New York. This advance is due to the recent increase in duty.

Nickel—Large lots, contract business, 40@45c. per lb. Retail, spot, from 50c. for 2000-lb. lots, up to 55c. for 500-lb. lots. The price for electrolytic is 5c. higher.

Cadmium—Current quotations are 75c. per lb. in 100-lb. lots at Cleveland, Ohio. In Germany 450@475 marks per 100 kg., at factory in Silesia.

Zinc and Lead Ore Markets

Platteville, Wis., Sept. 18—The highest price paid for zinc ore was $50 per ton; the base price of 60 per cent. ore, was $47@48 per ton. The base price of lead ore, 80 per cent., was $55@56 per ton.

SHIPMENTS, WEEK ENDED SEPT. 18.

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Benton	611,140	.....	.....
Highland	538,450	.....	.....
Cuba City	490,210	84,930	52,245
Platteville	440,150	.....	242,100
Hazel Green	334,400	80,000	.....
Galena	320,000	.....	.....
Livnigston	140,000	.....	.....
Harker	96,000	.....	...
Days Siding	88,000	.....	.....
Rewey	59,700	86,000	.....
Total	3,118,050	250,930	294,345
Year to Sept. 18	94,596,080	5,870,300	8,429,125

In addition to the above there were shipped to the American Zinc Ore Separating Company, 683,590 lb. zinc ore.

Joplin, Mo., Sept. 18—The highest price paid for zinc sulphide ore was $52, the base ranging from $49 to $46 per ton of 60 per cent. zinc. Zinc silicate ore sold as high as $31 the base ranging from $25 to $26.50 per ton of 40 per cent. zinc. The average price, all grades, was $44.58. Lead ore sold freely at $56 per ton, and no higher price could be verified, though persistently rumored. The average price, all grades, was $55.90 per ton. Practically only one buyer was in the market—the Picher Lead Company. The Galena company purchased very lightly and the Granby Mining and Smelting Company and the St. Louis Smelting and Refining Company shipped no ore.

SHIPMENTS, WEEK ENDED SEPT. 18.

	Zinc, lb.	Lead, lb.	Value.
Webb City-Carterville	3,854,950	1,031,990	$117,558
Joplin	1,368,060	156,700	37,180
Prosperity	461,190	403,060	21,892
Galena	817,390	50,540	20,213
Duenweg	527,180	45,590	12,445
Aurora	469,940	.....	9,268
Badger	369,500	.....	9,052
Alba-Neck	308,750	.....	7,564
Spurgeon	255,780	74,430	6,559
Granby	378,700	980	5,925
Oronogo	157,180	57,570	4,474
Miami	264,280	.....	4,228
Carthage	144,850	.....	3,548
Quapaw	153,110	.....	3,305
Zincite	70,050	.....	1,751
Carl Junction	63,020	.....	1,575
Cave Springs	63,290	.....	1,550
Stott City	62,660	.....	1,503
Sarcoxie	54,890	.....	795
Totals	9,844,770	1,820,860	$270,385
38 weeks	427,329,600	64,730,800	$10,070,590

Zinc value, the week, $219,483; 38 weeks, $8,306,733
Lead value, the week, 50,902; 38 weeks, 1,763,857

MONTHLY AVERAGE PRICES

Month.	Zinc Ore. Base Price.		Zinc Ore. All Ores.		Lead Ore. All Ores.	
	1908.	1909.	1908.	1909.	1908.	1909.
January	$37.60	$41.25	$35.56	$38.46	$46.88	$52.17
February	36.63	36.94	34.92	34.37	49.72	50.50
March	36.19	37.40	34.19	34.71	49.90	50.82
April	35.40	38.63	34.08	37.01	52.47	55.63
May	34.19	40.06	33.39	37.42	56.05	56.59
June	33.06	44.15	32.07	40.35	60.48	57.52
July	34.55	43.06	31.67	41.11	59.90	53.74
August	36.53	48.25	33.42	44.54	60.34	57.60
September	37.63	.....	34.44	.....	54.59	.....
October	35.95	.....	33.28	.....	52.63	.....
November	39.13	.....	35.02	.....	54.53	.....
December	42.75	.....	39.63	.....	49.68	.....
Year	$36.63	.....	$34.31	.....	$53.93	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

With the buoyancy knocked out of the ore market, both zinc and lead, with the continued lower price offerings the output is being materially curtailed, and still the stock in bins continues to increase.

Chemicals

New York, Sept. 22—The chemical market shows a slight weakness and is quiet, except in futures on white arsenic.

Copper Sulphate—The market is weaker, quotations being $4.10 per 100 lb. in carload lots and $4.35 per 100 lb. in smaller parcels.

Arsenic—The spot market for white arsenic is very duil at 2.70@2.95c. per lb. The future market has been strong during the past week and about 600 tons changed hands at quotations around 2⅞c. per pound.

Imports and Exports—The imports and exports of chemicals and raw materials in the United States, seven months ended July 31, were as follows:

	Imports.	Exports.	Excess.
Copper sulph. lb.	.....	2,081,181	E. 2,081,181
Bleach, lb.	49,618,496	13,964	I. 49,604,532
Potash salts, lb.	217,668,404	1,857,886	I. 215,810,518
Soda salts, lb.	8 918,889	394,465	I. 8,524,424
Acetate lime, lb.	.....	47,433,731	E. 47,433,731
Nit. of soda, tons	216,613	5,509	I. 211,104
Phosphates, tons	6,202	633,613	E. 627,411
Sulphur, tons	18,427	13,166	I. 5,261
Pyrites, tons	399,810	.....	I. 399,810

Estimating sulphur contents of pyrites the total imports of sulphur this year were 178,351 tons. Exports include reëxports of foreign material.

Mining Stocks

New York, Sept. 22—The Stock Exchange has shown no very definite tendency during the week, some advances in quotations being offset by decreases in other securities. Conditions of business and crop prospects are not unfavorable and the advance in interest rates has not been sufficient to effect any serious check. Fluctuations have not been very heavy, in either direction. There was much activity in Vulcan Detinning, a stock not usually much traded in, but persons interested deny the existence of any special cause.

On the Curb trading was quite active. The copper stocks, as a rule, were rather firmer than in the preceding week, although the advances were small in amount. The Nevada gold stocks were rather quiet and inclined to weakness. Cobalt stocks were active and firm, this tendency being assisted by two dividend declarations—Nipissing, 7½ per cent., and LaRose 4 per cent. quarterly. Industrial stocks on the Curb were also active and advances were recorded in Standard Oil and in Southern Iron and Steel.

Boston, Sept. 21—Copper shares have had a fair market of late and, although it is one of specialties, the tone to the whole list inspires confidence.

Amalgamated has had a $5.50 advance, to $84.87½. Allouez spurted $8 to $61.50, although it is now below $60. The so-called Calumet & Hecla stocks attracted attention a week ago, but the market shows a broadening tendency and has worked away from their influence to an extent. Atlantic is weak on the likelihood of an assessment some time this year. This company has managed to pay its way for the past 30 years and, as a matter of fact, has paid back in dividends about the original amount paid in.

Nipissing attracted attention with its advance to $13, due to the increase in the dividend rate.

North Butte has been quiet and steady, while Butte Coalition rose to $27. Osceola touched $151, and Tamarack was also strong in sympathy. Lake has fluctuated about $2 during the week and closed at $37. U. S. Smelting common has advanced $4.37½ to $59. There is a strong pool at work in this specialty. U. S. Coal and Oil also rose $2.75 to $35, on the acquisition of the remaining holdings of the late R. D. Evans by the president of the company. American Zinc is now stronger, and is selling around $32 per share.

Curb trading has been largely in Davis-Daly, First National, Chino and Rhode Island Coal. Prices are generally above those of a week ago.

STOCK QUOTATIONS

NEW YORK Sept. 22	
Name of Comp.	Clg.
Alaska Mine	‡.11
Amalgamated	84¼
Anaconda	50⅜
Balaklala	‡2 1/16
British Col. Cop.	6½
Buffalo Mines	3⅛
Butte Coalition	26⅞
Colonial Silver	‡ 7/16
Cum. Ely Mining	7⅛
Davis-Daly	6⅜
Dominion Cop.	7
Douglas Copper	1/16
El Rayo	2¾
Florence	2 5/16
Foster Cobalt	‡.32
Furnace Creek	‡ 05
Giroux	9¼
Gold Hill	⅛
Goldfield Con.	7
Granby	101
Greene Gold	‡⅛
Greene G. & S.	‡9
Guanajuato	1¾
Guggen. Exp.	215
Hanapah	‡15
Kerr Lake	8⅝
McKinley-Dar.	.90
Miami Copper	16⅛
Micmac	1/16
Mines Co. of Am.	3/16
Montezu. of C. R.	24
Mont. Sho. C.	2⅛
Nev. Utah M. & S.	1 1/16
Newhouse M. & S.	2¾
Nipissing Mines	12⅜
Old Hundred	⅛
Silver Queen	.39
Stewart	1/16
Tennessee Cop'r.	37¼
Tri-Bullion	1 1/16
United Copper	10¼
Utah Apex	‡4⅝
Utah Copper	50½
Yukon Gold	5¼

‡Last quotation.

BOSTON Sept. 22	
Name of Comp.	Clg.
Adventure	6¼
Allouez	60
Am. Zinc	32
Arcadian	4⅝
Arizona Com.	45½
Atlantic	9⅜
Boston Con.	15
Calumet & Ariz.	104½
Calumet & Hecla	685
Centennial	42⅜
Copper Range	81
Daly-West	8
East Butte	11¾
Franklin	17¼
Greene—Can.	9½
Hancock	11¼
Isle Royal	24
Keweenaw	3
La Salle	16
Mass	8
Michigan	10¾
Mohawk	63
Nevada	24½
North Butte	58½
Ojibway	9
Old Colony	.65
Old Dominion	55¾
Osceola	150
Parrot	31⅞
Quincy	92½
Rhode Island	‡4⅜
Shannon	15¾
Superior	58⅜
Superior & Bost.	16
Superior & Pitts.	16½
Tamarack	72
Trinity	12½
U. S. Smg. & Ref	58⅝
U.S.Sm. & Re., pd	53½
Utah Con.	45⅛
Victoria	3¾
Winona	8
Wolverine	153¼
Wyandotte	2¼

‡Last quotation.

N. Y. INDUSTRIAL	
Am. Agri. Chem.	45⅞
Am. Smelt. & Ref.	100¾
Am.Sm. & Ref., pf.	113
Colo. Fuel & Iron	46
Federal M. & S., pf.	‡91½
National Lead	90¾
National Lead, pf.	‡112
Pittsburg Coal	22
Republic I. & S.	44¼
Republic I. & S., pf.	108¾
Sloss-Sheffield	89¼
Standard Oil	‡685
U. S. Steel	85
U. S. Steel, pf.	128¾
Va. Car. Chem.	48⅛

BOSTON CURB	
	Low.
Ahmeek	230
Chemung	17
Chino	8¾
Globe Con.	‡4½
Gila	9⅛
Mason Valley	2
Ray Central	2¼
Ray Con.	21¼
San Antonio	8
Yuma	2⅛

Furnished by Hornblower & Weeks, N. Y.

ST. LOUIS Sept. 18		
N. of Com.	High.	Low.
Adams	.40	.30
Am. Nettie	.09	.07
Center Cr'k	1 80	1.60
Cent.C.&C.	86 00	84.00
C.C. & C. pf.	85.00	83.00
Cent. Oil	115.00	100.00
Columbia	9.00	7.00
Con. Coal	19.00	17 00
Doe Run	115.00	105 00
Gra. Bimet.	.30	.25
St. Joe	12 50	11.00

LONDON Sept. 22			
Name of Com.	Clg.		
Dolores	£1	5s	0d
Stratton'sInd.	0	3	3
Camp Bird	1	10	6
Esperanza	2	18	0
Tomboy	1	1	3
El Oro	1	5	6
Oroville	0	14	0

Cabled through Wm. P. Bonbright & Co., N. Y.

NEVADA STOCKS. Sept. 22.
Furnished by Weir Bros. & Co., New York.

Name of Comp.	Bid.	Name of Comp.	Bid.
COMSTOCK STOCKS		Silver Pick	.12
Belcher	.90	St. Ives	.09
Best & Belcher	.55	Triangle	.01
Caledonia	.45	BULLFROG STOCKS	
Challar	.25	Gibraltar	.02
Comstock	‡.28	Homestake King.	.01
Con. Cal. & Va.	‡1.42	Mont. Shoshone C.	1.87½
Crown Point	‡1.20	Tramp Cons	.04
Exchequer	.34	MISCELLANEOUS	
Gould & Curry	.25	Cumberland Ely.	7.00
Hale & Norcross	.40	Giroux	9.62½
Mexican	1 37	Greenwa'r Copper	.04
Ophir	1 20	Nevada Con.	24.25
Overman	‡.46	Nevada Hills	.70
Potosi	.59	Navada Smelting.	.87½
Savage	.51	Nevada Wonder	.70
Sierra Nevada	.48	Nevada-Utah	1.50
Union	.63	Penn-Wyoming	...
Utah	.06	Pittsburgh S. Pk.	.58
Yellow Jacket	1.57	Ray Central	2.25
TONOPAH STOCKS		Ray Con.	20.50
Belmont	.75	Round Mt. Sphinx	.05
Extension	‡.57		
Golden Anchor	...		
Jim Butler	.12		
MacNamara	.29		
Midway	.18		
Montana	.95		
North Star	.02		
Tono'h Mine of N.	6.87½		
West End Con.	.26		
GOLDFI'D STOCKS			
Adams	.01		
Atlanta	.13		
Blue Bell	.02		
Booth	.12		
C.O.D. Con.	.08		
Columbia Mt.	.09		
Comb. Frac.	.71		
Cracker Jack	.02		
Dia'dfield B. B. C.	.01		
Florence	2.93		
Goldfield Belmont	.04		
Goldfield Daisy	.12½		
Great Bend	.06		
Jumbo Extension	.15		
Kendall	.02		
Lone Star	.02		
May Queen	.04		
Oro	.05		
Red Hill	.05		
Sandstorm	.05		

COLO. SPRINGS Sept. 17	
Name of Comp.	Clg.
Acacia	.08
C. C. Con.	‡ 03⅛
Dante	‡.07
Doctor	.09
Elkton	.74½
El Paso	.65
Findlay	.11¼
Gold Dollar	.13
Gold Sovereign	.04½
Isabella	.22
Jack Pot	‡.08½
Jennie Sample	.08
Jerry Johnson	‡.06¼
Lexington	‡.01¾
Mary McKinney	.49
Pharmacist	.03½
Portland	.83½
U. G. M.	.08½
Vindicator	.75
Work	.07

Assessments

Company.	Delinq.	Sale.	Amt.
Alta Gladstone, Utah	Sept. 15	Oct. 20	$0.00½
Andes, Nev.	Sept. 14	Oct. 5	0.10
Arcadian, Mich.	Sept. 1	Sept. 31	0.50
Bonanza Mt. Copper, Ida.	Sept. 7	Oct. 7	0.001
Boulder Cr'k M. & M., Wash.	Aug. 31	Sept. 30	0.01
Brunswick Con. Va., Nev.	Oct. 1	Oct. 22	0.02
Challenge Con., Nev	Sept. 28	Oct. 18	0.10
Copper Mt. M. & D., Ida.	Sept. 7	Oct. 4	0 003
East Buffalo, Ida.	Sept. 10	Oct. 10	0.000½
Hancock Con., Mich.	Oct. 10		1 00
Hypotheek, M. & M., Ida.	Aug. 26	Sept. 25	0 005
Laclede, Ltd, Ida.	Aug. 23	Sept. 21	0.003
Lady Washington, Nev.	Aug. 31	Sept. 20	0.05
Mexican, Nev.	Sept. 10	Oct. 4	0.10
New Hope, Ida.	July 15	Sept. 25	0.002
Overman, Nev	Sept. 8	Sept. 29	0.05
Sierra Nevada, Nev.	Oct. 12	Nov. 3	0.10
So. Columbus Con., Utah	Sept. 20	Oct. 20	0 000½
Wilbur Min. Co., Ida.	Sept. 13	Oct. 5	0.05
Winona Mich.	Sept. 14		1.00
Zenoli Silver Copper, Utah.	Sept. 10	Sept. 27	0.01

Monthly Average Prices of Metals

SILVER

Month.	New York.		London.	
	1908.	1909.	1908.	1909.
January	55.678	51.750	25.738	23.834
February	56.000	51.472	25.855	23.706
March	55.365	50.468	25.570	23.227
April	55.505	51.428	25.133	23.708
May	52.795	52.905	24.377	24.343
June	53.663	52.538	24.760	24.166
July	53.115	51.043	24.514	23.519
August	51.683	51.125	23.858	23.588
September	51.720	.....	23.877	.....
October	51.431	.....	23.725	.....
November	49.647	.....	22.933	.....
December	48.766	.....	22.493	.....
Total	52.864	.....	24.402	.....

New York, cents per fine ounce; London, pence per standard ounce.

COPPER

	NEW YORK.				LONDON.	
	Electrolytic		Lake.			
	1908.	1909.	1908.	1909.	1908.	1909.
January	13.726	13.893	13.901	14.280	62.386	57.688
February	12.905	12.949	13.098	13.295	58.786	61.198
March	12.704	12.387	12.875	12.826	58.761	56.231
April	12.743	12.56½	12.928	12.93⅞	58.331	57.363
May	12.598	12.893	12.788	13.238	57.387	59.338
June	12.675	13.214	12.877	13.548	57.842	59.627
July	12.702	12.880	12.933	13.363	57.989	58.556
August	13.462	13.007	13.639	13.296	60.500	59.393
September	13.388	.....	13.600	.....	60.338	.....
October	13.354	.....	13.646	.....	60.139	.....
November	14.130	.....	14.386	.....	63.417	.....
December	14.111	.....	14.411	.....	62.943	.....
Year	13.208	.....	13.424	.....	59.902	.....

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

TIN AT NEW YORK

Month.	1908.	1909.	Month.	1908.	1909.
January	27.380	28.060	July	29.207	29.125
February	28.978	28.290	August	29.942	29.966
March	30.577	28.727	September	28.815	.....
April	31.702	29.445	October	29.444	.....
May	30.015	29.225	November	30.348	.....
June	28.024	29 322	December	29.154	.....
			Av. year.	29.465	.....

Prices are in cents per pound.

LEAD

Month.	New York.		St. Louis	London.	
	1909.	1909.	1909.	1908.	1909.
January	3.691	4.175	4.025	14.469	13.113
February	3.725	4.018	3.868	14.250	13.313
March	3.838	3.986	3.835	13.975	13.438
April	3.993	4.168	4.051	13.469	13.297
May	4.253	4.287	4 214	12.938	13.225
June	4.466	4.350	4.291	12.600	13.031
July	4.744	4.321	4.188	13.000	12.563
August	4.580	4.363	4.227	13.375	12.475
September	4.515	.....	.....	13.125	.....
October	4.351	.....	.....	13.375	.....
November	4.330	.....	.....	13.538	.....
December	4.213	.....	.....	13.156	.....
Year	4.200	.....	.....	13.439	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month.	New York.		St. Louis.		London.	
	1908.	1909.	1908.	1909.	1908.	1909.
January	4.513	5.141	4.363	4.991	20.563	21.425
February	4.788	4.889	4.638	4.739	20.875	21.563
March	4.665	4.757	4.527	4.607	21.075	21.438
April	4.645	4.965	4.495	4.815	21.344	21.531
May	4.608	5.124	4.458	4.974	19.906	21.975
June	4.543	5.402	4.393	5.252	19.000	22.000
July	4.485	5.402	4.338	5.252	19.031	21.969
August	4.702	5.729	4.556	5.579	19.350	22.125
September	4.769	.....	4.619	.....	19.563	.....
October	4.801	.....	4.651	.....	19.750	.....
November	5.059	.....	4.909	.....	20.875	.....
December	5.137	.....	4.987	.....	20.625	.....
Year	4.726	.....	4.578	.....	20.163	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.